AD

Research and Development Technical Report
ECOM-0090-F

RELIABLE INTEGRATED WIRE TERMINATION DEVICES

FINAL REPORT

By

D. L. Pfendler

D. H. Gould

July 1973

DISTRIBUTION STATEMENT

Approved for public release;
distribution unlimited.

ECOM

UNITED STATES ARMY ELECTRONICS COMMAND · FORT MONMOUTH, N.J.

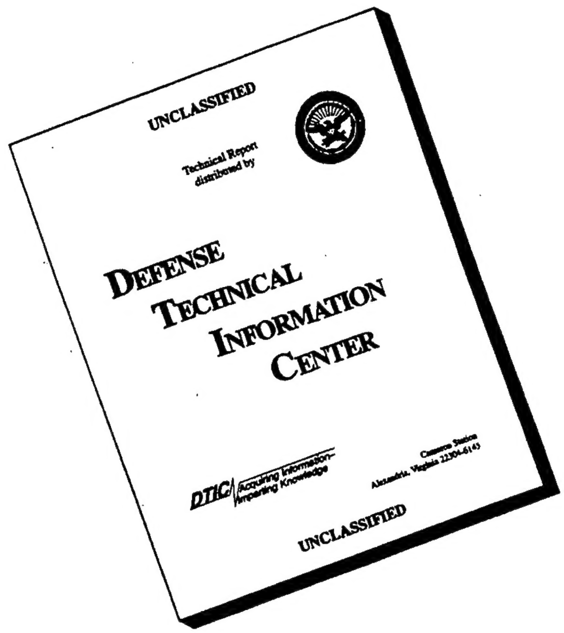
CONTRACT DAAB07-71-C-0090

THE BENDIX CORPORATION
ELECTRICAL COMPONENTS DIVISION
SIDNEY, NEW YORK 13838

NOTICES

DISCLAIMERS

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

TR ECOM-0090-F

July 1973

Report Control Symbol

OSD - 1366

RELIABLE INTEGRATED WIRE TERMINATION DEVICES

Final Report

January 1, 1971/January 31, 1973

Contract No. DAAB07-71-C-0090

DA Project No. 1F162203A 119 35 01

Prepared by

D. L. Pfendler and D. H. Gould

The Bendix Corporation
Electrical Components Division
Sidney, New York

FOR

U.S. ARMY ELECTRONICS COMMAND, FORT MONMOUTH, N. J.

DISTRIBUTION STATEMENT

Approved for public release;
distribution unlimited.

ABSTRACT

This final report covers an investigation into the design and evaluation of a single wire termination system capable of interconnection to various existing designs of multi-contact connectors. The devices utilizing this termination system were to be capable of assembly and maintenance with a common tool. In addition, the devices were to reliably withstand the environmental conditions encountered by ground and airborne Army equipment with emphasis on improvement for Army aircraft. The concept designed and evaluated makes waterproof connectors having crimp removable MS27491 series contacts practical to produce. However, to obtain sound insert moldings, minimum spacing between contact centerlines had to be established as follows:

Terminal Size	22D	20	16	12
Minimum Space	.090 in. (tentative)	.130 in.	.190 in.	.238 in.

It was found that the contact spacing of MIL-C-81511 connectors is inadequate for use with MS27491-22D contacts. Terminal insertion and removal tools were obtained, evaluated, and found useful. Terminal insertion and removal tips used for 22D contacts were mechanically weak. If the tip wall section must be increased, which is still to be determined, or if the dielectric wall thickness between contact cavities is inadequate for a reliable design, then the .090 in. spacing for this contact size may have to be increased.

FOREWORD

The work described in this report was authorized by the United States Army Electronics Command, under contract DAAB07-71-C-0090, DA Project 1F162203A119, Task 35, Sub-task 01.

This is the final report as prepared by The Bendix Corporation, Electrical Components Division, Sidney, New York with Mr. Elmer Godwin and Mr. Edward Ryan as ECOM Project Monitors.

CONTENTS

I.	Introduction		1
II.	Detailed Report		2
	A.	Connector Assemblies	2
	B.	Dielectric Terminal Retention on the Terminals	8
	C.	Terminal Insertion and Removal Tools	8
	D.	Hard Conductive Coating	9
III.	Conclusions and Recommendations		10
	A.	Connector Assemblies	10
	B.	Dielectric Terminal Retention on the Terminals	12
	C.	Terminal Insertion and Removal Tools	12
	D.	Hard Conductive Coating	13

ILLUSTRATIONS

Figure	Subject	Page
1	Drawing L-27758-1	14
2	" L-27758-2	15
3	" L-27758-8	16
4	" L-27758-4	17
5	" L-27758-24	18
6	" L-27758-25	19
7	" L-27758-26	20
8	" L-27758-27	21
9	" L-27758-11	22
10	" L-27758-31	23
11	" L-27758-30	24
12	" L-27758-9	25
13	" L-27758-10	26
14	" L-27758-40	27
15	" L-27758-47	28
16	" L-27758-108	29
17	" L-27758-109	30
18	" L-27758-123	31
19	" L-27758-107	32
20	18-85 Arrangement Dielectric Terminal Retention	33
21	18-85 Arrangement Metallic Terminal Retention	34
22	18-85 Arrangement Metallic Retention Assembly Cutaway	35
23	22-55 Arrangement Dielectric Retention Assembly	36

ILLUSTRATIONS (continued)

Figure	Subject	Page
24	22-55 Arrangement Dielectric Retention Cutaway	37
25	22-55 Arrangement Metallic Retention Cutaway	38
26	Enlarged View, Contact with Dielectric Retention	39
27	Burndy Contact Insertion Tools	40

Appendix

Engineering Laboratory Report 12-5193
Engineering Laboratory Report 12-5194
Engineering Laboratory Report 12-5204
Internal Memorandum T73-35
Battelle Letter to USAECOM 3-17-72
Distribution List
Form DD1473

TECHNICAL REPORT

I. Introduction

This report has as its subject the development of reliable integrated termination devices. A definition of an integrated termination device can be given as a device that for any one electrical contact size (22, 20, 16, etc.) only one configuration of contact would be used. This one contact can then be assembled into a device such as an electrical connector, relay, switch, etc. that is intermateable with specific devices currently available.

The purpose of this development was to limit the numerous designs of electrical contacts required at present in a user's stock to one single type which would replace all other crimp type contact designs now in use. In addition, accomplishing this purpose would simultaneously reduce the application tools required to one set. At the same time the performance capabilities, such as remaining sealed during water immersion, of fixed contact connectors and the conveniences of crimp insertable contact connectors were to be combined in the one device.

II. Detailed Report

A. Connector Assemblies

Initial layouts were made to document a number of concepts that could be used for an integrated termination system. The first layout made (Figure 1) shows that either a male or female electrical contact could be used as a terminal with the same basic retention mechanism (metallic or dielectric). A second layout was produced (Figure 2) to depict a number of possible methods of retaining an MS 27491 or MS 27493 type electrical contact used as a terminal. Items 2, 3, and 4 on this layout could be used in relays, switches, etc. which have large contact spacing and can utilize an exposed terminal. All other items in Figure 2 were rejected as being too expensive to produce, unproduceable, or unworkable. Connector assembly drawings for MIL-C-81511 intermateable type devices incorporating the metallic retention method illustrated in Figure 3 and the dielectric retention concept shown in Figure 4 were completed based on the following: (see Figures 5 through 8).

1. The standard MS 27491 socket contact would be used as the terminal. The choice of the socket contact was based on the following:

   a. The electrical contacting surface of the socket contact is self protected with the usual steel sleeve. The mating pin is buried in the insulators and is thereby protected in comparison to being completely exposed to damage if the pin contact was chosen as the terminal.

   b. The socket contact can continue to be manufactured by suppliers capable of producing a relatively complex part. The production of the relatively simple pin in the terminating device can be accomplished by manufacturers who may not have and would not need the capability of producing the socket contact.

   c. If the socket contact is damaged it could be easily replaced if used as the terminal compared to replacing the socket in a wiring device.

   d. The MS 27491 socket contact was the shortest in length and smallest in diameter available for use.

2. At one point in time it was thought that terminals with two or more ranges of engaging and separating forces (to lower electrical resistance through the contacts) and of a shorter length (to shorten overall connector length) should be evaluated. However, these ideas were rejected in light of the expected small effect on contact resistance and the increased loading required of the relatively weak contact insertion tools, with only a small decrease in overall length. Also, and more important, the introduction of a new contact which would add to the existing proliferation of contacts would defeat the purpose of the overall investigation.

The relatively weak contact insertion tools are caused by the fact that the width of the shoulder on the contact, used for contact/terminal retention, dictates the wall section of the insert tool. Review of the dimensions of the MS 27491, size 22D contact shoulder shows that .007 inch is the nominal width of the shoulder. The .007 inch must then be divided into clearance between the inside diameter of the tool and the contact crimp barrel and tolerance on inside and outside diameter of the tool. The result is a tool tip that is subject to deformation and damage during use. An increase in the shoulder width on the contact and, therefore, a proportionate increase in wall section of the tool for increased strength would also require a like increase in contact hole center-to-center distance.

A study of the detail component drawing and the mold drawing for the MIL-C-81511 intermateable prototype in the 18-85 arrangement, both dielectric and metallic retention, lead to less than 100% confidence in the ability of either retention system to meet all of the performance requirements. The extremely thin walls of the retention towers and the walls between the retention mechanisms in this size and arrangement results in thin walls in the molds and supports the less than 100% confidence. These thin walls required special time consuming machining procedures to be developed to produce the molds.

A layout was made (see Figure 9) to investigate the possibility of producing the MIL-C-81511, 18-85 arrangement, dielectric retention, by employing a contact with special diameters and lengths as compared to the MS 27491 series contact. The new contact would have a longer area to the rear of the retention shoulder to allow for the length required at the .040 inch diameter. The engaging end of the terminal would be a size 23. The idea was rejected due to the decision to use standard MS contacts as the terminals.

After an expenditure of considerable time and money to produce molds for the two inserts forming the dielectric retention mechanism section (Figures 10 and 11) a concentrated effort was made to mold the inserts. However, little or no success could be obtained in molding complete and useable inserts and accordingly experienced representatives of the manufacturer of the material used in the inserts were consulted. During a conference with ECOM representatives, Bendix-ECD's personnel, and the material manufacturer's representatives it was agreed that the .005 inch thick molded walls in these inserts were at that time beyond the state of the art capability, but were not considered impossible. The inability to fill the thin cavity in the molds was the basic cause of not obtaining complete and useable components. The walls that were produced were homogeneous and non-porous.

In addition to the Polymer 360 (Minnesota Mining and Manufacturing) molding compound used for dielectric terminal retention mechanisms, many other materials have been considered and/or evaluated in the past at Bendix-ECD. The materials and reason(s) for rejection are as follows:

Item	Material	Reason(s) for Rejection
1	Polycarbonate, GE Lexan	Non-resistant to various solvents.
2	Polyphenylen Oxide, GE, Grade 531	Non-resistant to various solvents.
3	Polysulfone, Union Carbide, P1700	Non-resistant to various solvents.
4	Nylon, 20% glass reinforced, LNP	Non-resistant to various solvents.
5	Tefzel HT2007-4, duPont	Lack of required mechanical properties (contact retention).
6	Tefzel 200, duPont	Lack of required mechanical properties (contact retention).
7	Tefzel HT2004-5, duPont	Lack of required mechanical properties (contact retention).
8	Tefzel HT2007-2, duPont	Lack of required mechanical properties (contact retention).
9	Polyethersulfone, Imperial Chemical Industries, P720	Non-availability of material (experimental material).

10	Glass reinforced polyester, Celanese X-917 (3300)	Lack of required mechanical properties (contact retention).
11	Trogamid T, Dynamit-Nobel	Non-resistant to various solvents.
12	Polyimidal, 15% glass filled, Raychem	Lack of required mechanical properties (contact retention).

Due to the lack of additional time and money in the contract, a decision was made with Bendix-ECD and USAECOM mutual concurrence to drop further development of the MIL-C-81511 intermateable, 18-85 arrangement, dielectric retention connector assemblies with the integrated wire termination concept.

Prototype MIL-C-81511 intermateable, 18-85 arrangement, metallic terminal retention samples were then tooled and produced and tested. Three basic failure modes were encountered during the testing. The three modes were not unexpected as the failures occurred in those areas that were new in the design of the connector. The three modes of failure were: (1) air leakage, (2) dielectric withstanding voltage breakdown and (3) terminal retention. The causes for failure were: (1) sealing of the fixed contact, (2) too thin insulation wall between contact cavities, and (3) faulty terminal retention mechanisms. The method of sealing the fixed contacts, the amount of insulation between contact cavities, and the stock thickness of the retention mechanism were all unique in this connector design.

As stated above, the results of testing the prototype MIL-C-81511, 18-85 arrangement metallic retention samples indicated that, except for the three failure modes, the connectors met the requirements of the specification. One area of interest is that of contact resistance because of the additional number of joints between contacts. Although the average contact resistance (one terminal end to other terminal end) is 50% more for 22 and 20 AWG wire and 25% more for 26 AWG wire for the integrated wire termination connector compared to the standard MIL-C-81511 connector, it still meets or is within the maximum limits set by the Military Specification. Also, the resistance (one terminal end to other terminal end) is no greater than a similar length of wire.

With corrective action taken for all three failure modes in effect, preproduction samples of MIL-C-81511, 18-85 arrangement, metallic terminal retention samples were fabricated and evaluated according to specific sections of Bendix-ECD test procedure L-15081-98, no revision, dated March 19, 1972. The corrective action was as follows:
(1) inspection to insure round retention clips to improve contact retention,
(2) grit blasting of bonding area between insert assembly and shell to improve seal and, (3) attempt to improve dielectric withstanding voltage capabilities between contact holes in the insert assembly. The results of the testing are reported in Bendix-ECD Engineering Laboratory Report 12-5193 (see appendix). A copy of the test procedure is included in this report.

Because of the large number of dielectric withstanding voltage failures in the 18-85, MIL-C-81511 type samples tested, the test was discontinued by mutual agreement between USAECOM and Bendix-ECD. A program was then initiated to determine the capability to produce 18-85 metallic retention inserts which would pass the required dielectric withstanding voltage tests.

The capability study was accomplished as follows:

A dielectric withstanding voltage test fixture was fabricated which electrically stressed the dielectric walls in the insert by introducing a highly electrically conductive gas into the contact cavities and outside of the insert. The dielectric withstanding voltage test applies the test voltage between each contact cavity and all other adjacent contact cavities tied in common. The highly conductive gas is employed because the flash-over test voltage required is approximately one-fourth that required in air. Also the gas will permeate through semi-porous molded walls that air would not enter.

A number of different molding compounds were tried to obtain electrically good inserts. The mold fabricated for the 18-85 arrangement metallic terminal retention insert was utilized. The mold was used by production personnel on production equipment under Materials Laboratory personnel supervision to obtain the best combination of personnel and equipment available. All transfer molding was performed while the mold was under vacuum. The materials used, the condition, and the results of the dielectric withstanding voltage test with the previously described test fixture are as follows:

a. Allied Chemical Epiall 1288BX-unheated preforms:
4 of 5 failed at 1300 VAC before bushing removal
1 of 1 failed at 1300 VAC after bushing removal

b. Allied Chemical Epiall 1288BX-preheated preforms:
4 of 4 failed at 1300 VAC before bushing removal
4 of 4 failed at 1300 VAC after bushing removal

c. Fiberite E3938C - unheated preforms:
4 of 4 failed at 1300 VAC before bushing removal
4 of 4 failed at 1300 VAC after bushing removal

d. Fiberite E3938C - preheated preforms
4 of 4 failed at 1300 VAC before bushing removal
4 of 4 failed at 1300 VAC after bushing removal

e. Allied Chemical Epiall 1961 - unheated preforms:
5 of 7 failed at 1300 VAC before bushing removal
1 of 2 failed at 1300 VAC after bushing removal
0 to 1 failed at 1300 and 1800 VAC after retention mechanism assembled.

f. Allied Chemical Epiall 1908 - unheated preform:
1 of 6 failed at 1300 VAC before bushing removal
0 of 5 failed at 1300 VAC after bushing removal
0 of 4 failed at 1300 and 1800 VAC after retention mechanism assembled.

Note: One of the above inserts was damaged during retention mechanism assembly and, therefore, would not fit the test fixture for dielectric withstanding voltage testing. In all of the above inserts that failed the dielectric withstanding voltage test, the failure was due to porosity in the thin dielectric wall between terminal retention devices.

At the request of ECOM, drawings were made for devices utilizing the integrated wire termination system concept, intermateable with connectors in accordance with U.S. Army Materiel Command drawing number 11176551, 22-55 arrangement. These prototype assemblies with both metallic and dielectric retention mechanisms were evaluated according to a test program concurred on by USAECOM. A review of the test data indicated that, although both types of terminal retention mechanisms operated satisfactorily, the dielectric retention type seemed to be somewhat better than the metallic type in the area of terminal insertion and withdrawal. Since the dielectric terminal retention device is a full "collet" shaped mechanism, it seems to better "center" the terminal during insertion and withdrawal as compared to the metallic device which has the retention tines of the clip not directly opposite each other, thereby pushing the contact to one side. Note that, as expected, the same degree of difficulty in molding the dielectric retention mechanism component and the metallic retention component for the 22-55 arrangement devices was not present as in the 18-85 arrangement. This was due to the thicker walls of the dielectric between holes and the thicker walls of the retention towers because of the .130 inch center to center spacing.

Evaluation of the U.S. Army Materiel Command drawing 11176551/ MIL-C-26482, 22-55 arrangement dielectric terminal retention pre-production samples according to Bendix-ECD test procedure L-15081-98, no revision, dated March 1972 was completed. The results of this testing is reported in Bendix-ECD Engineering Laboratory Report 12-5194 (see Appendix). Due to the unavailability of shells from the manufacturer, the insert assemblies were assembled in shells with MIL-C-26482 intermating dimensions for the evaluation of the termination method. The results of testing the prototype and pre-production connectors that are intermateable with connectors in accordance with U.S. Army Materiel Command drawing 11176551 indicate a capability to meet all the requirements of the test program.

B. Dielectric Terminal Retention on the Terminals

Detailed component drawings for a size 22 terminal incorporating the concept of dielectric terminal retention as shown in Figures 12 and 13 were made. After considerable review of these details (see Figures 14 and 15) with Experimental and Production personnel, a conclusion was reached that due to the extremely small overall size of the retention clip and the undercut required on the inside, no attempt could be made to machine or mold the retention clip. It was then recommended to USAE COM by Bendix-ECD, and an agreement was reached, to evaluate this concept of terminal retention by evaluating a size 16 terminal with the dielectric retention mechanism on the contact. Detailed component drawings for this mechanism were made and components fabricated for a size 16 terminal (see Figures 16 through 18).

The construction of the dielectric terminal retention device on the terminal consist of a semi-flexible retention device that is captive in an undercut on the terminal (see Figure 19). When the terminal is inserted into a electrical device insert hole (.137 diameter) with a standard contact insertion tool, the retention device will collapse or reduce in size (this is allowed by the full length slot) thus requiring a rather low force for terminal insertion. When the insertion tool is removed the retention device will open up (increase in size due to its spring properties) and retain itself against the undercut shoulder in the insert hole. The terminal can be removed by inserting a removal tool that will reverse the above procedure. The results of the evaluation of this method of terminal retention are reported in Bendix-ECD report T-73-35 (see Appendix). These results show that the required force to insert and remove the terminal was well within the normal accepted limits. The terminal retention force at failure was more than twice the normal force required for a removable contact.

C. Terminal Insertion and Removal Tools

As the terminal in the basic integrated wire termination device is fully enclosed within a wiring device, there is no possible visual inspection that can be made to insure that the terminal is fully seated. One possible solution to the problem is an insertion tool, manufactured by the Burndy Corporation, which

incorporates a test feature to insure that the terminal is fully seated and locked. It incorporates a modification of the plastic insertion tool at its tip and in the handle portion are spring loaded jaws which grip the wire insulation well back of the terminal. Using this tool the terminal is inserted into the wiring device and as the tool is pulled out, the spring loaded jaws apply a force to the wire (4 pounds for a size 20 terminal) before it trips and the tool can be removed. If the terminal is not fully seated and locked in place, it will be pulled out of the wiring device as the tool is removed. A standard tool was also modified by Burndy Corporation for use with size 22D terminals and applying 2 pounds of trip-out force. The two tools, produced by the Burndy Corporation, one for size 20 terminals and one for size 22D terminals, were evaluated according to Bendix-ECD test procedure L-15081-92, revision A (as modified by Burndy letter of 11-24-72). The results of this test program are recorded in Bendix-ECD Engineering Laboratory Report 12-5204 (see Appendix). The test program consisted of evaluating the tool for its ability to insert terminals, the effect on various types and size of wire insulation, and general handling characteristics. The results of the testing indicate a general capability of the tool to perform according to the requirements of the test program.

D. Hard Conductive Coating

Bendix-ECD reviewed the technical report covering the development of the hard conductive coating [1] for steel, aluminum, and magnesium for USA ECOM by Battelle Institute under contract DAAB07-69-C-0133. The coating is an electroplated lusterless nickel plating. A review of the technical reports by Bendix-ECD plating personnel resulted in the following comments relative to the possible use of this coating for electrical connector assembly components.

1. The plating is adaptable only to flat surfaces.

2. Barrel plating is not possible. All parts would have to be rack plated, limiting the quantity that could be plated in a given time.

3. In order to plate round surfaces, the parts would have to be continually rotated in the plating bath.

4. The plating thickness used, .002 inch [2] is entirely too thick for connector applications. All threads would have to be heavily undercut.

Reference 1 - Research and Development Technical Reports ECOM-0360-1, ECOM-0360-3, ECOM-0360-F.

Reference 2 - Research and Development Technical Report, ECOM-0360-F (Interim Final)

5. It would be doubtful that good adhesion, especially after thermal shock, would be obtained without having a zincate treatment prior to plating.

6. Its good abrasion and corrosion resistance is probably due to its heavy thickness.

7. Its lubricity is probably a result of the inclusion of carbon particles in the plating.

8. Problems would be encountered in plating blind holes, whether threaded or not.

9. In plating thicknesses common to connector parts (.0002 inch) plated parts probably would not pass corrosion resistance tests.

The above comments on the coating were transmitted to Battelle Institute by USA ECOM for review. The reply is contained in a letter from Battelle Institute dated March 17, 1972 (see Appendix). Since the above comments were made, ECOM personnel have shown Bendix-ECD personnel some round electrical connector components that were plated with this hard conductive coating that indicated the plating can be applied to round surfaces without continually rotating the parts. Also, it would appear that parts could be barrel plated rather than need to be rack plated only. In addition to the above, it is understood that further work is being performed at USAECOM in the refinement of this plating.

III. Conclusions and Recommendations

A. Connector Assemblies

Based on the initial guide lines reached during the contract; i.e., the use of the MS 27491 series socket contact as a terminal in electrical devices, the following conclusions and recommendations can be reached:

1. The concept that was designed and evaluated during the contract makes possible the use of a waterproof connector with crimp removable MS 27491 series contacts used as terminals.

2. Electrical connectors with the integrated wire termination method, utilizing MS 27491 series contacts as terminals, can be produced with the following combination of minimum center line to center line spacing and terminal size:

Spacing	Terminal Size
.090	22D
.130	20
.190	16
.238	12

Note: The .090 inch spacing for size 22D terminals is based on the use of insertion/removal tools that are mechanically weak. If improvements of the current tools can not be accomplished, it may be necessary to increase the spacing for size 22D terminals to allow an increase in tool wall-section.

3. The contact center line to center line spacing of MIL-C-81511 type electrical connectors (all contact sizes) is inadequate for either a metallic or dielectric terminal retention system from a standpoint of fabricating sound moldings. Within the time period and funding available during this contract, it was not possible to produce usable dielectric terminal retention components (see Figures 10, 11, and 20). The study program to determine the capability to produce electrically sound 18-85 arrangement metallic terminal retention inserts resulted in an overall yield of 20%. It is not economically feasible to produce any components on a 20% yield factor.

4. The plastic insertion removal tools for contact sizes 22, 22D, 22M (MIL-C-38999, MS 27491) and 23 (MIL-C-81511) are very weak due to the thin wall section of their tips making them difficult to use and subject to deformation during use. It is recommended that some improvements be made in the resistance to damage of the insertion-removal tools.

5. This termination concept would decrease substantially the large variety of contacts and application tools now required to be stocked by equipment and airframe contractors, including Military spare parts organizations.

6. The cost of the integrated wire termination devices would probably be higher than any comparable device now available. The increased initial cost, however, might be compensated by a reduced cost of installation due to changing from a solder operation to a machine controlled crimp termination.

7. No substitute has been found for the Polymer 360 (Minnesota Mining and Manufacturing trademark) molding compound for fabrication of the dielectric terminal retention mechanism regardless of the temperature at which the mechanism is to be used. No other material has the required combination of physical properties, temperature resistance, and resistance to solvents.

8. The dielectric terminal retention mechanism manufactured of Polymer 360 material can physically be the same part as used in conventional type connectors.

9. Based on the studies made by drawing layout and physically producing assemblies (see Figures 21 through 25) it is possible to produce electrical devices that are intermountable and intermateable with devices currently available. These studies have also shown that the devices would be generally longer on the termination end and therefore would weigh somewhat more.

10. Since the concept combines two methods of retaining contacts that are currently produced by a number of electrical connector manufacturers (sealed contacts and crimp removable contacts), the reliability of the concept should be on a high level.

11. Two methods of sealing the fixed contacts to their insert were considered - molding into place or separately sealed (or bonded) in a molded insert with contact holes. During the contract the latter method was used to reduce the use of skilled and expensive molding equipment operator labor for loading contacts into the mold. The experience gained during the contract has indicated that although to bond contacts into the insert is less expensive, the total labor for assembling the contacts into the inserts results in about the same total expense as loading contacts into a mold. From a performance viewpoint although both methods of producing fixed contact inserts would require a leakage test, less failures would probably occur with molded-in contacts. A potential manufacturer of electrical devices would require a review of both methods to determine the best choice to fit his operation at that time.

12. Within certain limitations, this termination concept is easily adaptable to provide glass sealed connectors, waterproof connectors, and filtered contact connectors all with crimp type wire terminations. The advantages of not requiring the application of heat (solder type wire terminations) which would affect waterproofness and hermeticity, or burn out filters on contacts are very evident.

B. Dielectric Terminal Retention on the Terminals

Based on a limited number of samples tested, the dielectric retention system on the terminal has a good potential. The terminal insertion, release, and removal forces were within the usual specification requirements. The displacement while under load is also within the normal electrical connector specification requirement. In addition, the terminal retention force at destruction shows a favorable 2 to 1 factor of safety over the usual minimum requirement for terminal (or contact) retention (see Figure 26).

C. Terminal Insertion and Removal Tools

Evaluation tests of the two positive locking contact insertion tools, produced by the Burndy Corporation, showed that except for the smallest wire/insulation size, the tool performed as designed. The tools are capable of inserting and testing for seating of the contact (terminal) without damage to wire insulation or the contact crimp joint (see Figure 27).

D. Hard Conductive Coating

Although a conclusion has been reached by Bendix-ECD Plating Engineering Personnel that the hard conductive electro-plated lusterless nickel coating is not suitable at this time for use on electrical connector components, further investigation of the use of the coating on connector components should be made. The further investigation should in part include a visit of Battelle Institute personnel, with USA ECOM personnel, to an electrical connector manufacturer's plating facilities with discussion to conclude the differences in opinion on the suitability of the coating on connector components.

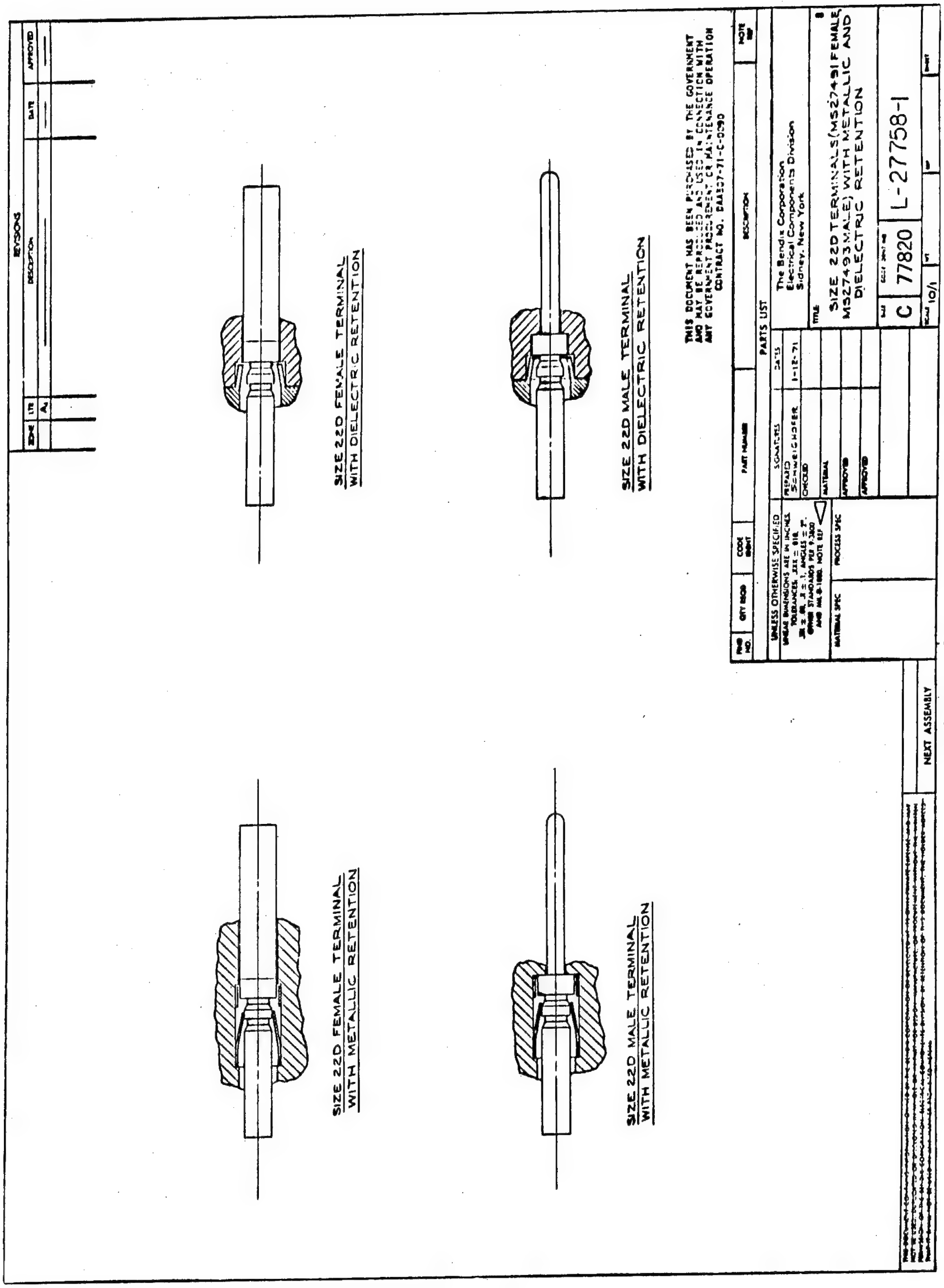
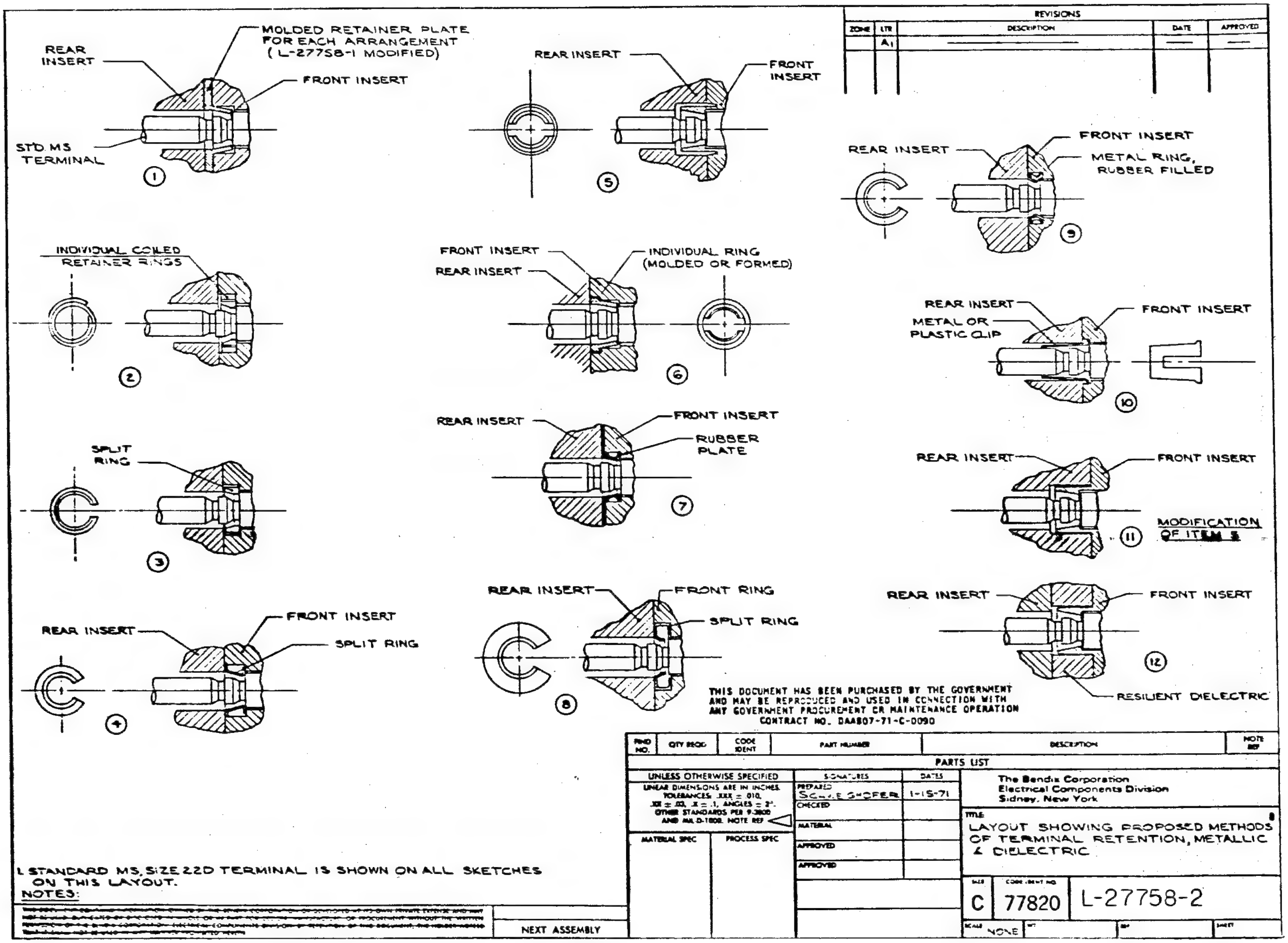

REVISIONS
SIZE 22D FEMALE TERMINAL WITH DIELECTRIC RETENTION
SIZE 22D MALE TERMINAL WITH DIELECTRIC RETENTION
SIZE 22D FEMALE TERMINAL WITH METALLIC RETENTION
SIZE 22D MALE TERMINAL WITH METALLIC RETENTION
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION
PARTS LIST
UNLESS OTHERWISE SPECIFIED
1-12-71
The Bendix Corporation
Electrical Components Division
Sidney, New York
SIZE 22D TERMINALS (MS27491 FEMALE, MS27493 MALE) WITH METALLIC AND DIELECTRIC RETENTION
C
77820
L-27758-1
10/1
NEXT ASSEMBLY

Figure 1.



REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVED
A1
REAR INSERT
MOLDED RETAINER PLATE FOR EACH ARRANGEMENT (L-27758-1 MODIFIED)
FRONT INSERT
STD MS TERMINAL
1
INDIVIDUAL COILED RETAINER RINGS
2
SPLIT RING
3
REAR INSERT
FRONT INSERT
SPLIT RING
4
REAR INSERT
FRONT INSERT
5
FRONT INSERT
REAR INSERT
INDIVIDUAL RING (MOLDED OR FORMED)
6
REAR INSERT
FRONT INSERT
RUBBER PLATE
7
REAR INSERT
FRONT RING
SPLIT RING
8
REAR INSERT
FRONT INSERT
METAL RING, RUBBER FILLED
9
REAR INSERT
METAL OR PLASTIC CLIP
FRONT INSERT
10
REAR INSERT
FRONT INSERT
11
MODIFICATION OF ITEM 5
REAR INSERT
FRONT INSERT
12
RESILIENT DIELECTRIC
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
FIND NO.
QTY REQD
CODE IDENT
PART NUMBER
DESCRIPTION
NOTE REF
PARTS LIST
UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES
MATERIAL SPEC
PROCESS SPEC
SIGNATURES
DATES
PREPARED
1-15-71
CHECKED
MATERIAL
APPROVED
APPROVED
The Bendix Corporation
Electrical Components Division
Sidney, New York
TITLE
LAYOUT SHOWING PROPOSED METHODS OF TERMINAL RETENTION, METALLIC & DIELECTRIC
SIZE
C
77820
L-27758-2
SCALE NONE
SHEET
1. STANDARD MS SIZE 22D TERMINAL IS SHOWN ON ALL SKETCHES ON THIS LAYOUT.
NOTES:
NEXT ASSEMBLY

Figure 2.

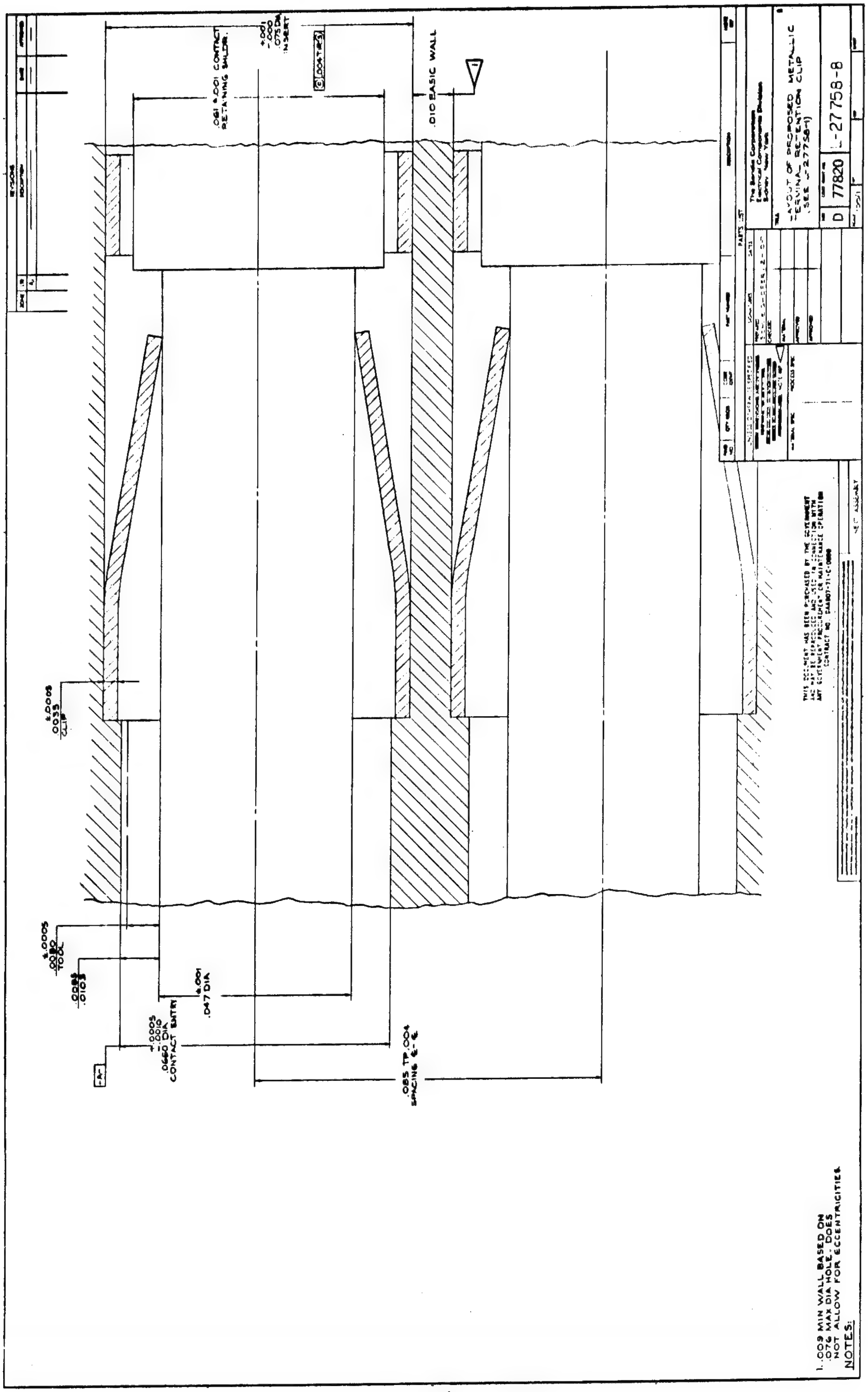

.010 BASIC WALL
.061 ±.001 CONTACT RETAINING SHLDR.
.047 DIA
.085 TP .004 SPACING ℄-℄
CONTACT ENTRY
LAYOUT OF PROPOSED METALLIC TERMINAL RETENTION CLIP (SEE L-27758-1)
D 77820 L-27758-8
NOTES:
1. .009 MIN WALL BASED ON .076 MAX DIA HOLE. DOES NOT ALLOW FOR ECCENTRICITIES

Figure 3.

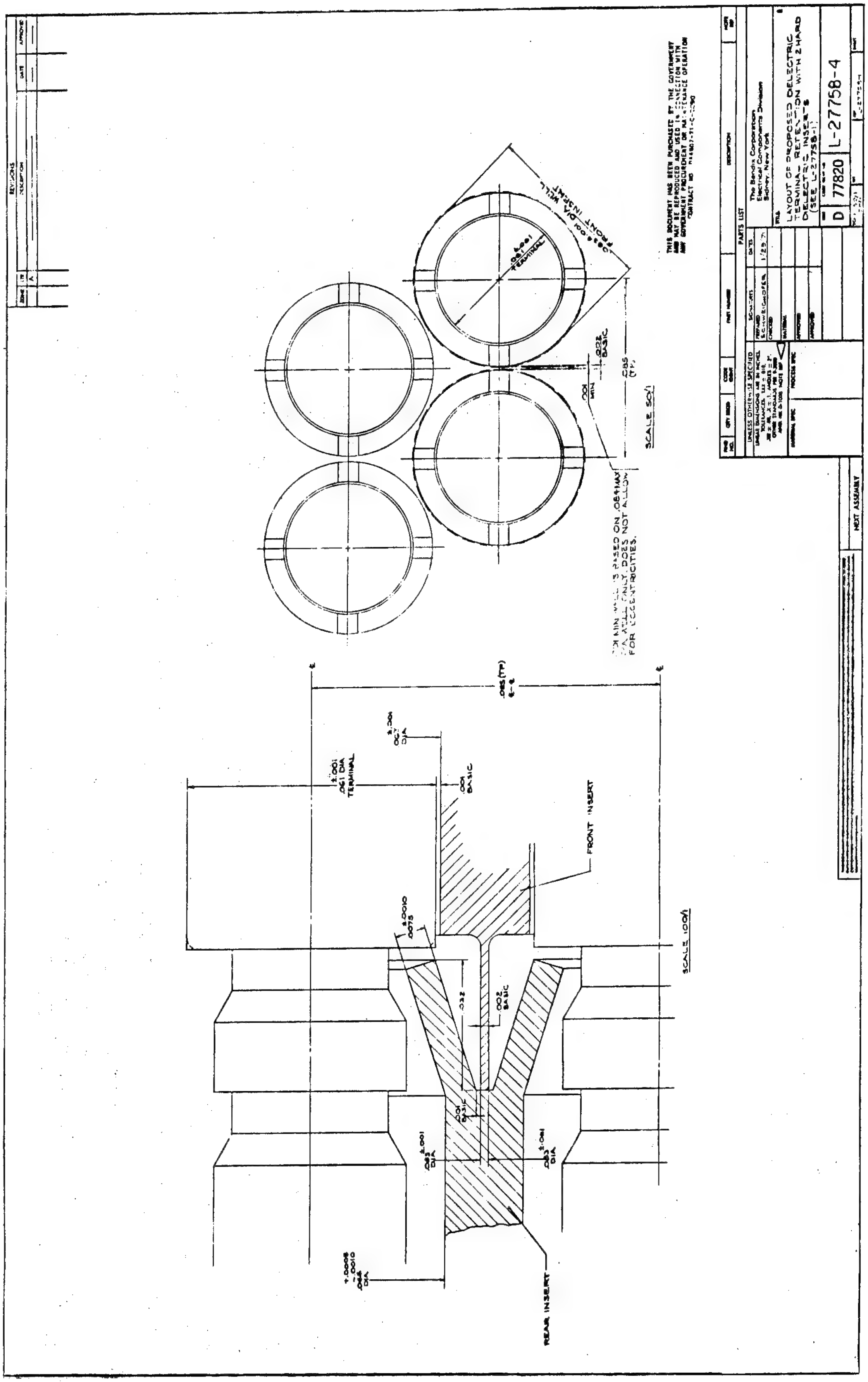

FRONT INSERT
REAR INSERT
SCALE 100/1
SCALE 50/1
The Bendix Corporation
Electrical Components Division
Sidney, New York
LAYOUT OF PROPOSED DIELECTRIC TERMINAL RETENTION WITH 2 HARD DIELECTRIC INSERTS
D 77820 L-27758-4
NEXT ASSEMBLY
PARTS LIST

Figure 4.

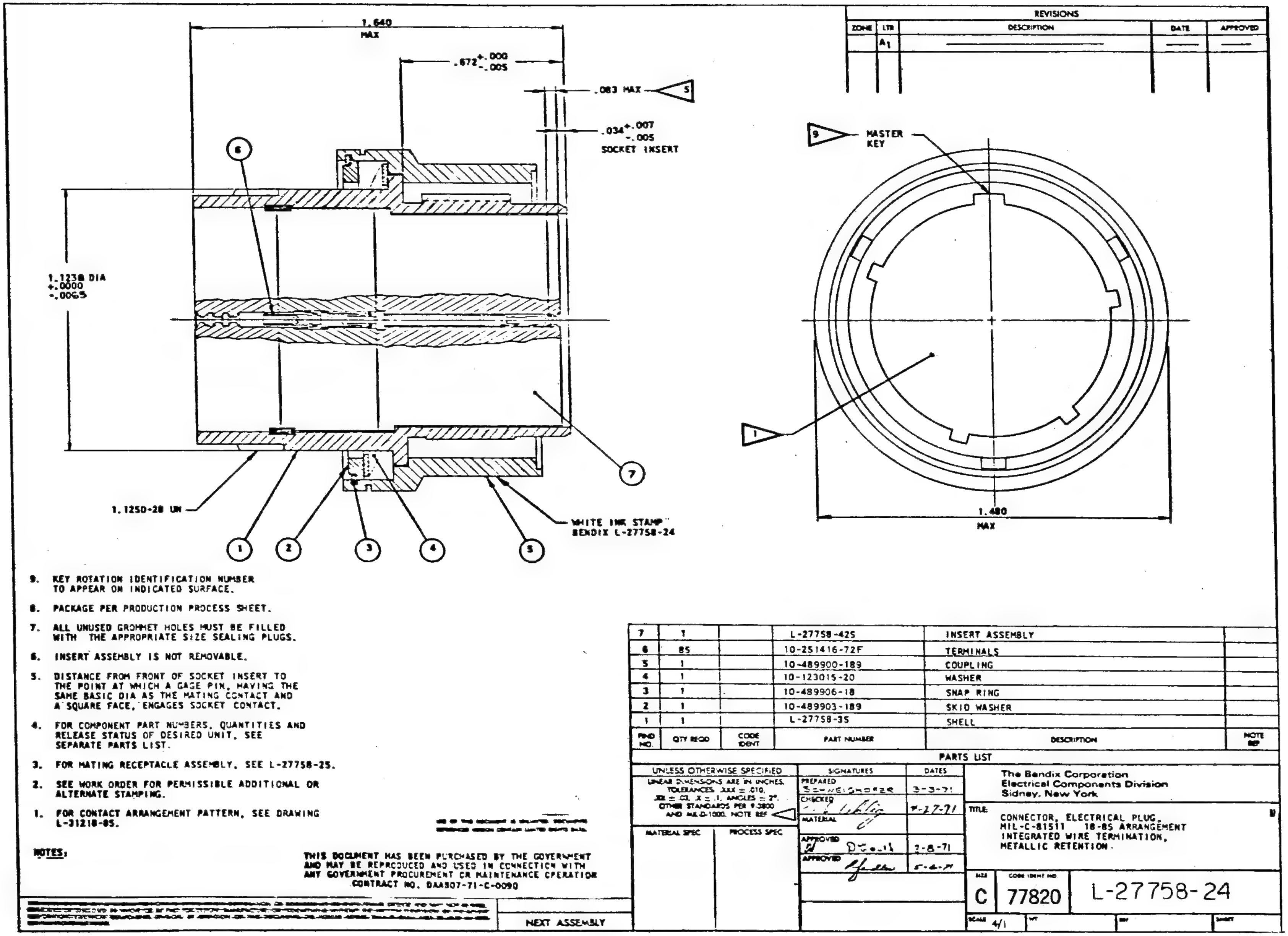

1.640
MAX
.672 +.000 -.005
.083 MAX
5
.034 +.007 -.005
SOCKET INSERT
1.1238 DIA
+.0000
-.0065
1.1250-28 UN
WHITE INK STAMP
BENDIX L-27758-24
MASTER KEY
9
1.480
MAX
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVED
A1
9. KEY ROTATION IDENTIFICATION NUMBER TO APPEAR ON INDICATED SURFACE.
8. PACKAGE PER PRODUCTION PROCESS SHEET.
7. ALL UNUSED GROMMET HOLES MUST BE FILLED WITH THE APPROPRIATE SIZE SEALING PLUGS.
6. INSERT ASSEMBLY IS NOT REMOVABLE.
5. DISTANCE FROM FRONT OF SOCKET INSERT TO THE POINT AT WHICH A GAGE PIN, HAVING THE SAME BASIC DIA AS THE MATING CONTACT AND A SQUARE FACE, ENGAGES SOCKET CONTACT.
4. FOR COMPONENT PART NUMBERS, QUANTITIES AND RELEASE STATUS OF DESIRED UNIT, SEE SEPARATE PARTS LIST.
3. FOR MATING RECEPTACLE ASSEMBLY, SEE L-27758-25.
2. SEE WORK ORDER FOR PERMISSIBLE ADDITIONAL OR ALTERNATE STAMPING.
1. FOR CONTACT ARRANGEMENT PATTERN, SEE DRAWING L-31218-85.
NOTES:
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
NEXT ASSEMBLY
7 1 L-27758-425 INSERT ASSEMBLY
6 85 10-251416-72F TERMINALS
5 1 10-489900-189 COUPLING
4 1 10-123015-20 WASHER
3 1 10-489906-18 SNAP RING
2 1 10-489903-189 SKID WASHER
1 1 L-27758-35 SHELL
FIND NO. QTY REQD CODE IDENT PART NUMBER DESCRIPTION NOTE REF
PARTS LIST
UNLESS OTHERWISE SPECIFIED
SIGNATURES
DATES
PREPARED 3-3-71
CHECKED 4-27-71
MATERIAL
APPROVED 2-8-71
APPROVED 5-4-71
MATERIAL SPEC
PROCESS SPEC
The Bendix Corporation
Electrical Components Division
Sidney, New York
TITLE
CONNECTOR, ELECTRICAL PLUG, MIL-C-81511 18-85 ARRANGEMENT INTEGRATED WIRE TERMINATION, METALLIC RETENTION.
SIZE C
CODE IDENT NO 77820
L-27758-24
SCALE 4/1

Figure 5.

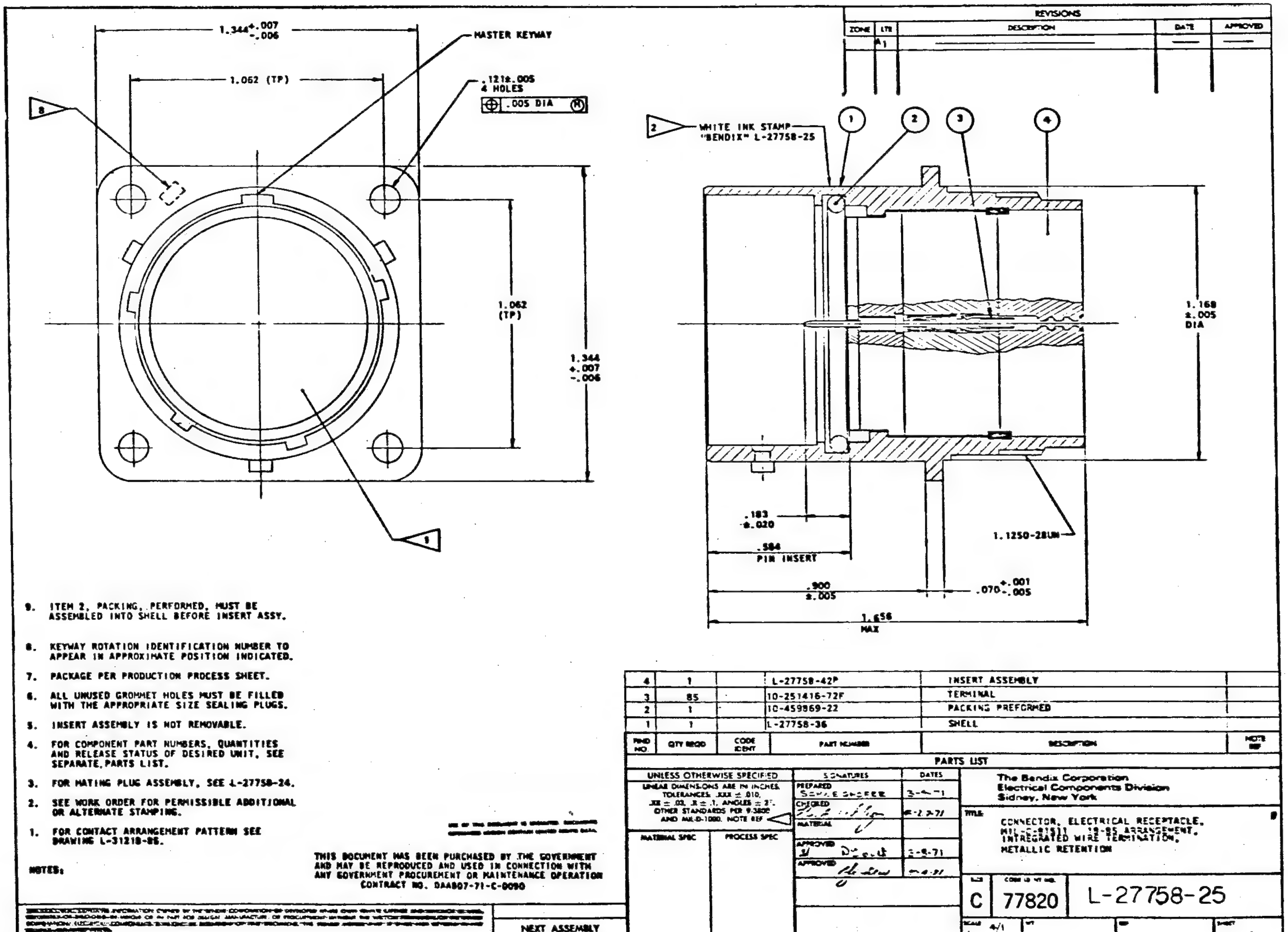
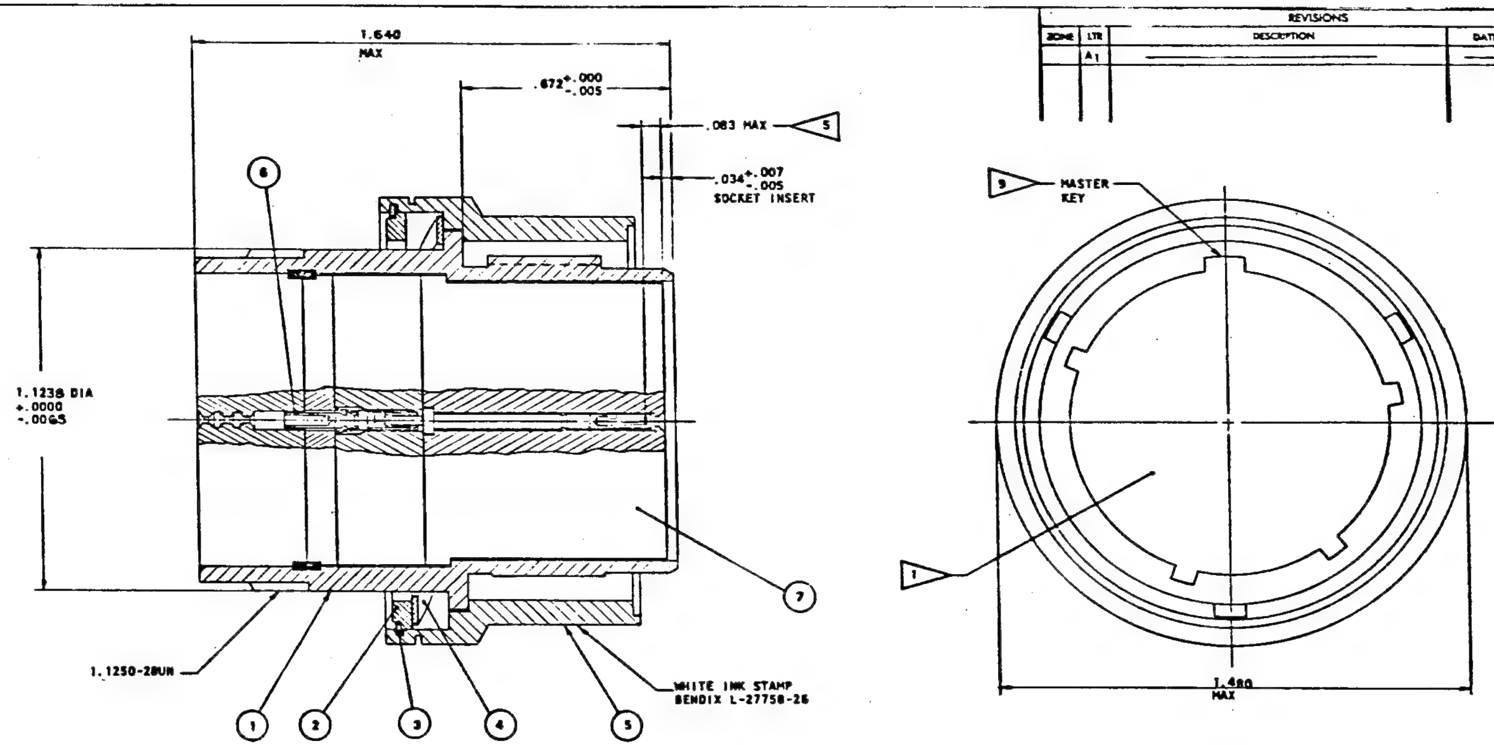

REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
1.344 +.007 -.006
1.062 (TP)
MASTER KEYWAY
.121±.005 4 HOLES
.005 DIA (M)
1.062 (TP)
1.344 +.007 -.006
WHITE INK STAMP "BENDIX" L-27758-25
1.168 ±.005 DIA
.183 ±.020
.584 PIN INSERT
1.1250-28UN
.900 ±.005
.070 +.001 -.005
1.656 MAX
9. ITEM 2, PACKING, PERFORMED, MUST BE ASSEMBLED INTO SHELL BEFORE INSERT ASSY.
8. KEYWAY ROTATION IDENTIFICATION NUMBER TO APPEAR IN APPROXIMATE POSITION INDICATED.
7. PACKAGE PER PRODUCTION PROCESS SHEET.
6. ALL UNUSED GROMMET HOLES MUST BE FILLED WITH THE APPROPRIATE SIZE SEALING PLUGS.
5. INSERT ASSEMBLY IS NOT REMOVABLE.
4. FOR COMPONENT PART NUMBERS, QUANTITIES AND RELEASE STATUS OF DESIRED UNIT, SEE SEPARATE, PARTS LIST.
3. FOR MATING PLUG ASSEMBLY, SEE L-27758-24.
2. SEE WORK ORDER FOR PERMISSIBLE ADDITIONAL OR ALTERNATE STAMPING.
1. FOR CONTACT ARRANGEMENT PATTERN SEE DRAWING L-31218-85.
NOTES:
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
NEXT ASSEMBLY
4 | 1 | L-27758-42P | INSERT ASSEMBLY
3 | 85 | 10-251416-72F | TERMINAL
2 | 1 | 10-459869-22 | PACKING PREFORMED
1 | 1 | L-27758-36 | SHELL
FIND NO | QTY REQD | CODE IDENT | PART NUMBER | DESCRIPTION | NOTE REF
PARTS LIST
UNLESS OTHERWISE SPECIFIED
SIGNATURES | DATES
PREPARED
CHECKED
MATERIAL
APPROVED
APPROVED
MATERIAL SPEC
PROCESS SPEC
The Bendix Corporation
Electrical Components Division
Sidney, New York
TITLE
CONNECTOR, ELECTRICAL RECEPTACLE,
INTEGRATED WIRE TERMINATION,
METALLIC RETENTION
C
77820
L-27758-25
SCALE 4/1

Figure 6.



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A1			

9. KEY ROTATION IDENTIFICATION NUMBER TO APPEAR ON INDICATED SURFACE.
8. PACKAGE PER PRODUCTION PROCESS SHEET.
7. ALL UNUSED GROMMET HOLES MUST BE FILLED WITH THE APPROPRIATE SIZE SEALING PLUGS.
6. INSERT ASSEMBLY IS NOT REMOVABLE.
5. DISTANCE FROM FRONT OF SOCKET INSERT TO THE POINT AT WHICH A GAGE PIN, HAVING THE SAME BASIC DIA AS THE MATING CONTACT & A SQUARE FACE, ENGAGES SOCKET CONTACT.
4. FOR COMPONENT PART NUMBERS, QUANTITIES AND RELEASE STATUS OF DESIRED UNIT, SEE SEPARATE PARTS LIST.
3. FOR MATING RECEPTACLE ASSEMBLY, SEE L-27758-27.
2. SEE WORK ORDER FOR PERMISSIBLE ADDITIONAL OR ALTERNATE STAMPING.
1. FOR CONTACT ARRANGEMENT PATTERN, SEE DRAWING L-31218-85.

NOTES:

THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090

FIND NO.	QTY REQD	CODE IDENT	PART NUMBER	DESCRIPTION	NOTE REF
7	1		L-27758-43S	INSERT ASSEMBLY	
6	85		10-251416-72F	TERMINALS	
5	1		10-489900-189	COUPLING	
4	1		10-123015-20	WASHER	
3	1		10-489906-18	SNAP RING	
2	1		10-489903-189	SKID WASHER	
1	1		L-27758-35	SHELL	

PARTS LIST

NEXT ASSEMBLY

UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES. TOLERANCES: .XXX ± .010, .XX ± .03, .X ± .1, ANGLES ± 1°. OTHER STANDARDS PER 9-3800 AND MIL-D-1000. NOTE REF

MATERIAL SPEC | PROCESS SPEC

SIGNATURES	DATES
PREPARED	3-5-71
CHECKED	4-27-71
MATERIAL	
APPROVED	3-9-71
APPROVED	

The Bendix Corporation
Electrical Components Division
Sidney, New York

TITLE: CONNECTOR, ELECTRICAL PLUG, MIL-C-81511 18-85 ARRANGEMENT, INTREGRATED WIRE TERMINATION, DIELECTRIC RETENTION

U

SIZE C | CODE IDENT NO. 77820 | L-27758-26

SCALE +/1 | WT | | SHEET

Figure 7.

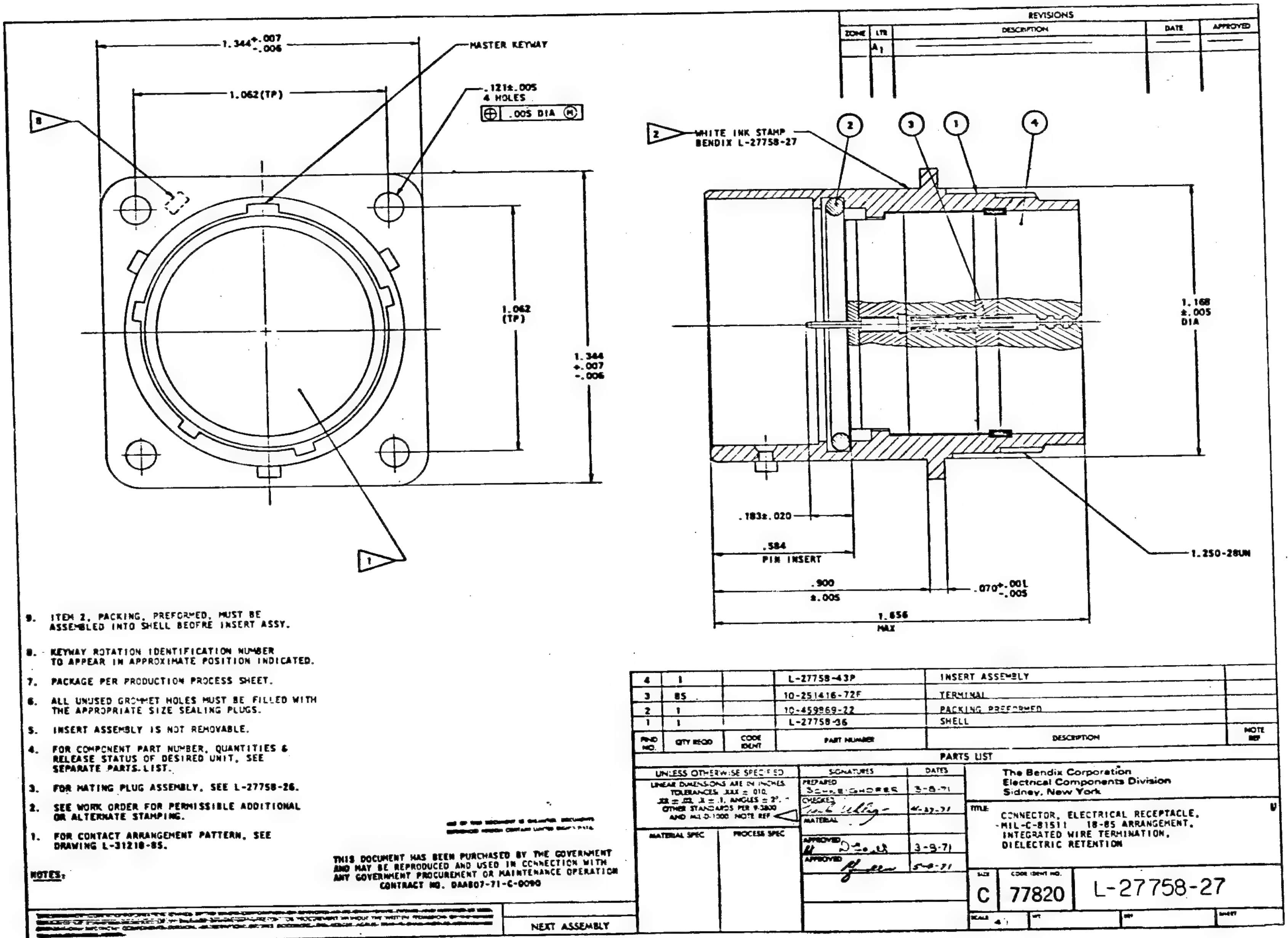

1.344 +.007 -.006
1.062 (TP)
MASTER KEYWAY
.121±.005
4 HOLES
.005 DIA (M)
1.062 (TP)
1.344 +.007 -.006
WHITE INK STAMP
BENDIX L-27758-27
1.168
±.005
DIA
.183±.020
.584
PIN INSERT
.900
±.005
.070 +.001 -.005
1.656
MAX
1.250-28UN
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVED
NOTES:
9. ITEM 2, PACKING, PREFORMED, MUST BE ASSEMBLED INTO SHELL BEOFRE INSERT ASSY.
8. KEYWAY ROTATION IDENTIFICATION NUMBER TO APPEAR IN APPROXIMATE POSITION INDICATED.
7. PACKAGE PER PRODUCTION PROCESS SHEET.
6. ALL UNUSED GROMMET HOLES MUST BE FILLED WITH THE APPROPRIATE SIZE SEALING PLUGS.
5. INSERT ASSEMBLY IS NOT REMOVABLE.
4. FOR COMPONENT PART NUMBER, QUANTITIES & RELEASE STATUS OF DESIRED UNIT, SEE SEPARATE PARTS LIST.
3. FOR MATING PLUG ASSEMBLY, SEE L-27758-26.
2. SEE WORK ORDER FOR PERMISSIBLE ADDITIONAL OR ALTERNATE STAMPING.
1. FOR CONTACT ARRANGEMENT PATTERN, SEE DRAWING L-31218-85.
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
NEXT ASSEMBLY
4 | 1 | L-27758-43P | INSERT ASSEMBLY
3 | 85 | 10-251416-72F | TERMINAL
2 | 1 | 10-459869-22 | PACKING PREFORMED
1 | 1 | L-27758-36 | SHELL
FIND NO. | QTY REQD | CODE IDENT | PART NUMBER | DESCRIPTION | NOTE REF
PARTS LIST
UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES
TOLERANCES .XXX ± .010, .XX ± .02, .X ± .1, ANGLES ± 2°.
OTHER STANDARDS PER 9-3800 AND MIL-D-1000 NOTE REF
MATERIAL SPEC
PROCESS SPEC
SIGNATURES
DATES
PREPARED
3-8-71
CHECKED
MATERIAL
APPROVED
3-9-71
APPROVED
5-9-71
The Bendix Corporation
Electrical Components Division
Sidney, New York
TITLE
CONNECTOR, ELECTRICAL RECEPTACLE, -MIL-C-81511 18-85 ARRANGEMENT, INTEGRATED WIRE TERMINATION, DIELECTRIC RETENTION
SIZE
C
CODE IDENT NO.
77820
L-27758-27
SCALE
SHEET

Figure 8.

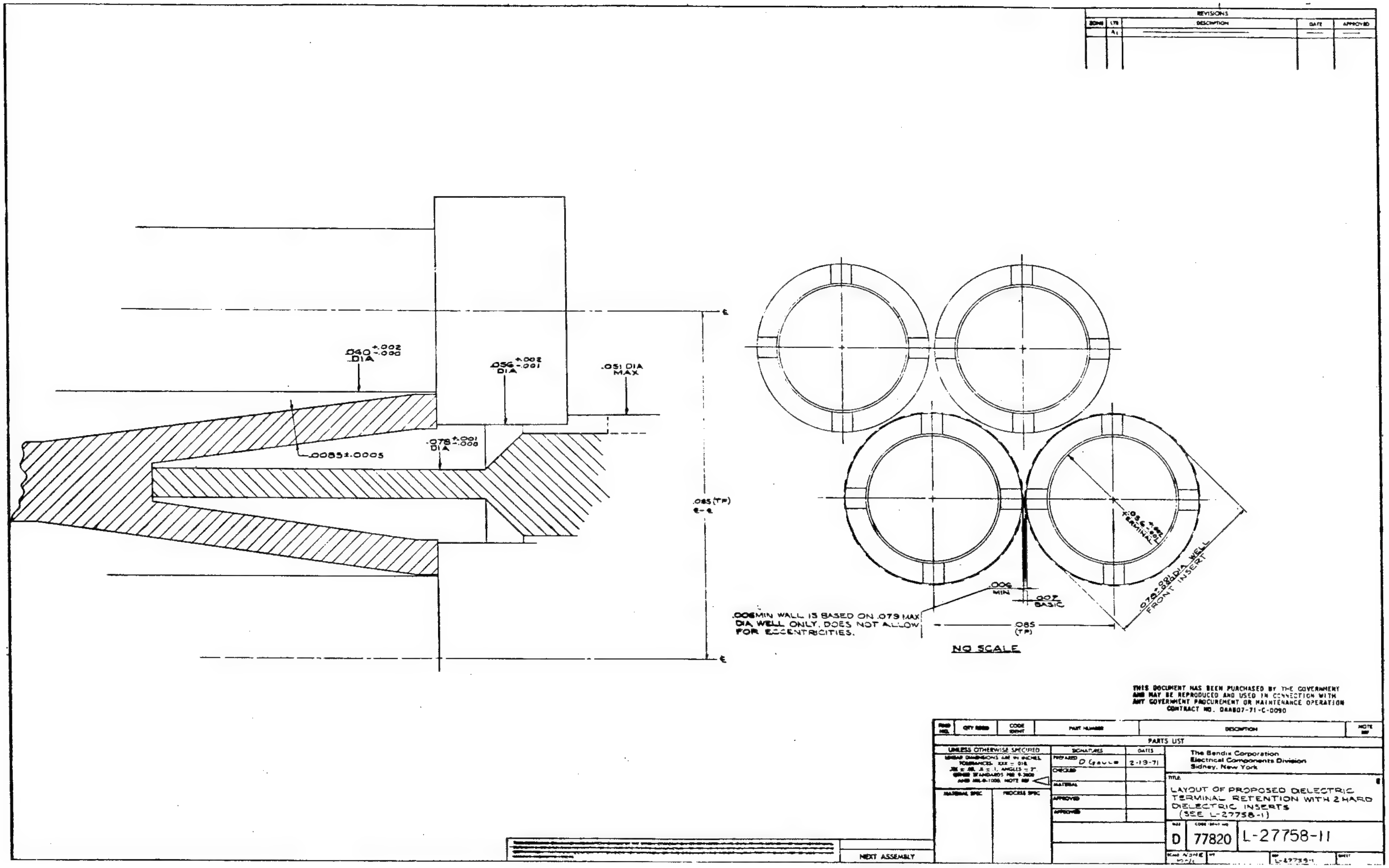

REVISIONS
.040 +.002 -.000 DIA
.056 +.002 -.001 DIA
.051 DIA MAX
.078 +.001 -.000 DIA
.0085±.0005
.085 (TP) ℄-℄
.006 MIN WALL IS BASED ON .079 MAX DIA WELL ONLY. DOES NOT ALLOW FOR ECCENTRICITIES.
.006 MIN
.007 BASIC
.085 (TP)
NO SCALE
FRONT INSERT
TERMINAL
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
PARTS LIST
UNLESS OTHERWISE SPECIFIED
2-19-71
The Bendix Corporation
Electrical Components Division
Sidney, New York
LAYOUT OF PROPOSED DIELECTRIC TERMINAL RETENTION WITH 2 HARD DIELECTRIC INSERTS (SEE L-27758-1)
D 77820 L-27758-11
NEXT ASSEMBLY

Figure 9.

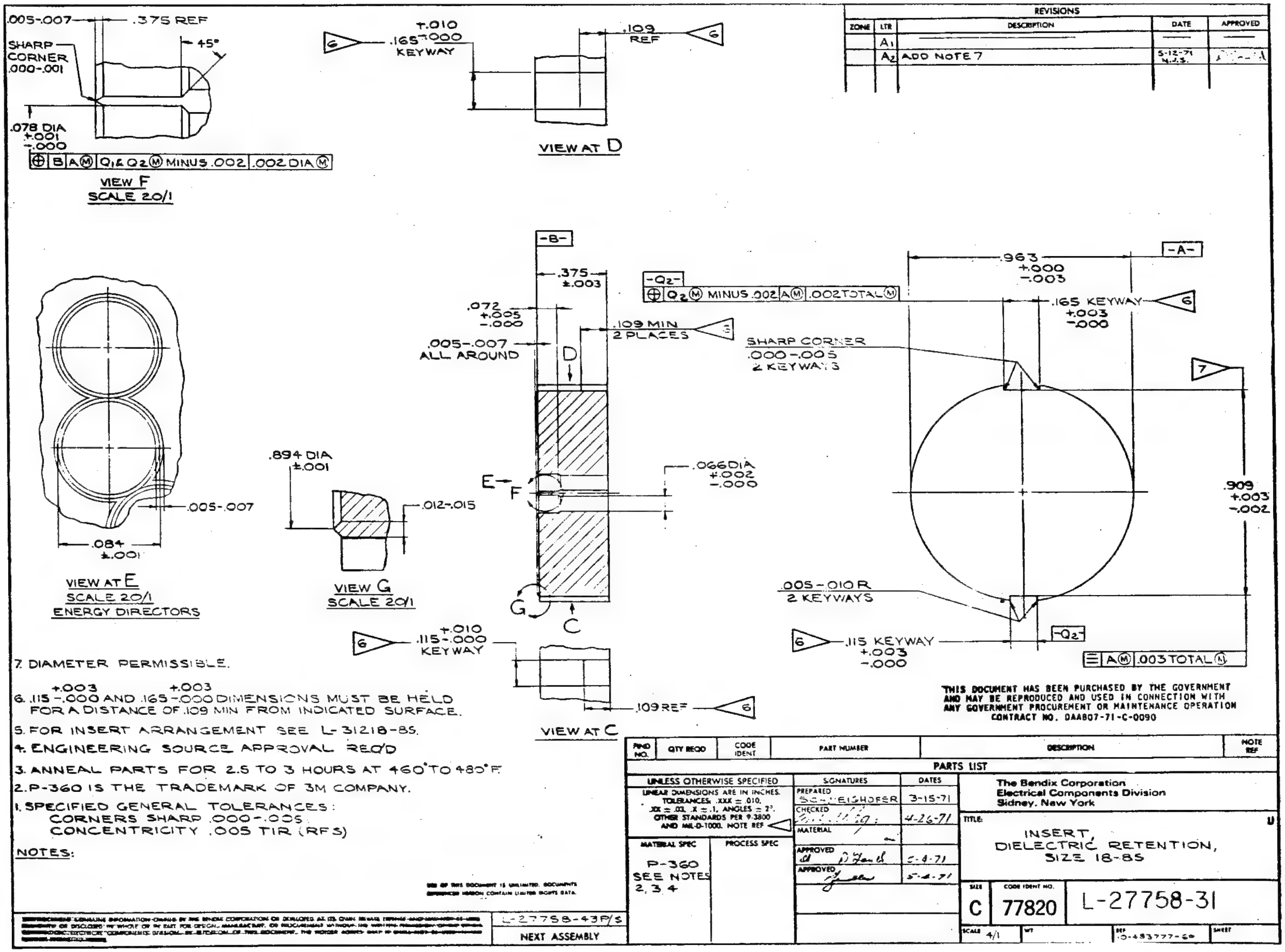

.005-.007
.375 REF
SHARP CORNER .000-.001
45°
.078 DIA +.001 -.000
B A Q1 & Q2 MINUS .002 .002 DIA
VIEW F SCALE 20/1
.165 +.010 -.000 KEYWAY
.109 REF
VIEW AT D
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVED
A1
A2
ADD NOTE 7
5-12-71
-B-
.375 ±.003
.072 +.005 -.000
.005-.007 ALL AROUND
.109 MIN 2 PLACES
D
-Q2-
Q2 MINUS .002 A .002 TOTAL
.963 +.000 -.003
-A-
.165 KEYWAY +.003 -.000
SHARP CORNER .000-.005 2 KEYWAYS
7
.894 DIA ±.001
.066 DIA +.002 -.000
E
F
.005-.007
.012-.015
.909 +.003 -.002
.084 ±.001
VIEW AT E SCALE 20/1 ENERGY DIRECTORS
VIEW G SCALE 20/1
G
C
.005-.010 R 2 KEYWAYS
.115 +.010 -.000 KEYWAY
.115 KEYWAY +.003 -.000
-Q2-
A .003 TOTAL
7. DIAMETER PERMISSIBLE.
6. .115 +.003 -.000 AND .165 +.003 -.000 DIMENSIONS MUST BE HELD FOR A DISTANCE OF .109 MIN FROM INDICATED SURFACE.
5. FOR INSERT ARRANGEMENT SEE L-31218-85.
4. ENGINEERING SOURCE APPROVAL REQ'D
3. ANNEAL PARTS FOR 2.5 TO 3 HOURS AT 460° TO 480°F
2. P-360 IS THE TRADEMARK OF 3M COMPANY.
1. SPECIFIED GENERAL TOLERANCES: CORNERS SHARP .000-.005 CONCENTRICITY .005 TIR (RFS)
NOTES:
.109 REF
VIEW AT C
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
FIND NO.
QTY REQD
CODE IDENT
PART NUMBER
DESCRIPTION
NOTE REF
PARTS LIST
UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES. TOLERANCES: .XXX = .010, .XX = .03, .X = .1, ANGLES = 2°.
OTHER STANDARDS PER 9-3800 AND MIL-D-1000. NOTE REF
SIGNATURES
DATES
PREPARED
3-15-71
CHECKED
4-26-71
MATERIAL
APPROVED
5-4-71
MATERIAL SPEC
PROCESS SPEC
P-360 SEE NOTES 2, 3, 4
The Bendix Corporation
Electrical Components Division
Sidney, New York
TITLE
INSERT, DIELECTRIC RETENTION, SIZE 18-8S
SIZE
C
CODE IDENT NO.
77820
L-27758-31
SCALE 4/1
L-27758-43P/S
NEXT ASSEMBLY

Figure 10.

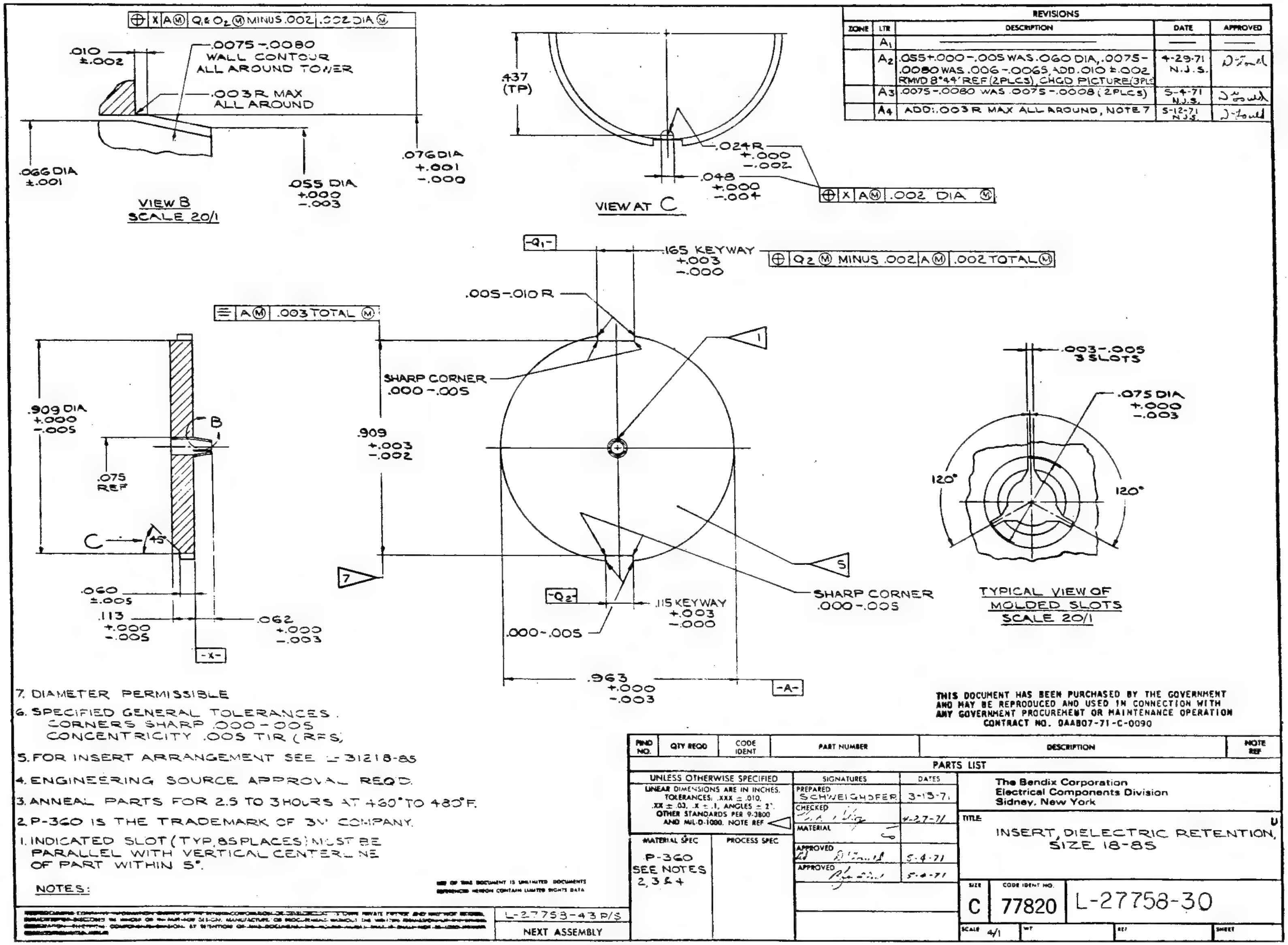
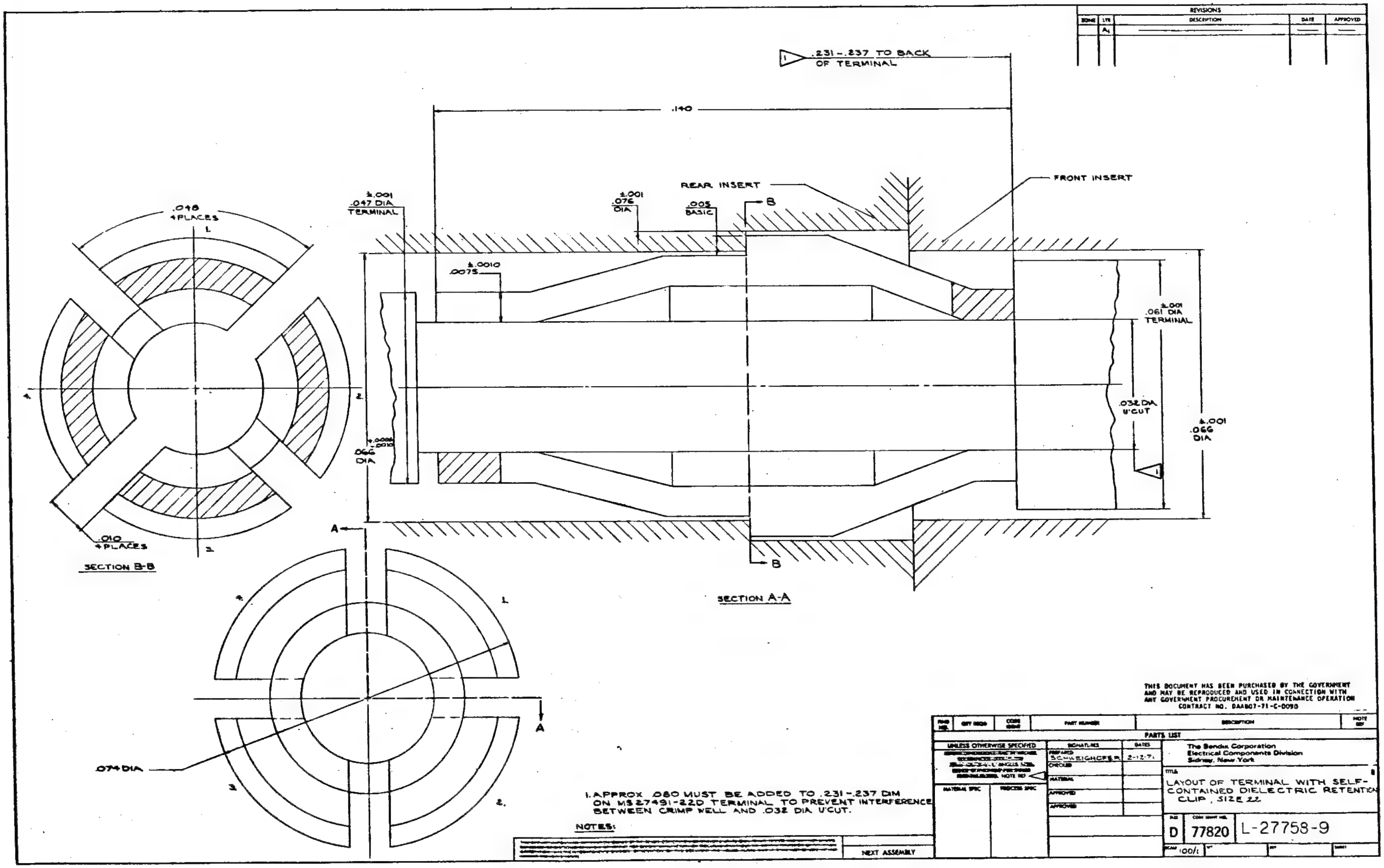

VIEW B
SCALE 20/1
VIEW AT C
.0075-.0080
WALL CONTOUR
ALL AROUND TOWER
.003R MAX
ALL AROUND
.165 KEYWAY
.115 KEYWAY
SHARP CORNER
.000-.005
TYPICAL VIEW OF
MOLDED SLOTS
SCALE 20/1
REVISIONS
A2 .055+.000-.005 WAS .060 DIA, .0075-.0080 WAS .006-.0065, ADD .010 ±.002
A3 .0075-.0080 WAS .0075-.0008 (2PLCS)
A4 ADD: .003R MAX ALL AROUND, NOTE 7
7. DIAMETER PERMISSIBLE
6. SPECIFIED GENERAL TOLERANCES. CORNERS SHARP .000-.005 CONCENTRICITY .005 TIR (REF)
5. FOR INSERT ARRANGEMENT SEE L-31218-85
4. ENGINEERING SOURCE APPROVAL REQD.
3. ANNEAL PARTS FOR 2.5 TO 3 HOURS AT 460°TO 480°F.
2. P-360 IS THE TRADEMARK OF 3M COMPANY.
1. INDICATED SLOT (TYP. 8 PLACES) MUST BE PARALLEL WITH VERTICAL CENTERLINE OF PART WITHIN 5°.
NOTES:
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION
CONTRACT NO. DAAB07-71-C-0090
PARTS LIST
The Bendix Corporation
Electrical Components Division
Sidney, New York
INSERT, DIELECTRIC RETENTION, SIZE 18-85
C 77820 L-27758-30
L-27753-43 P/S
NEXT ASSEMBLY
MATERIAL SPEC P-360 SEE NOTES 2, 3 & 4

Figure 11.



.231-.237 TO BACK OF TERMINAL
.140
REAR INSERT
FRONT INSERT
±.001 .047 DIA TERMINAL
±.001 .076 DIA
.005 BASIC
±.0010 .0075
±.001 .061 DIA TERMINAL
.032 DIA U'CUT
±.001 .066 DIA
.066 DIA
.048 4 PLACES
.010 4 PLACES
SECTION B-B
SECTION A-A
.074 DIA
1. APPROX .080 MUST BE ADDED TO .231-.237 DIM ON MS27491-22D TERMINAL TO PREVENT INTERFERENCE BETWEEN CRIMP WELL AND .032 DIA U'CUT.
NOTES:
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
PARTS LIST
UNLESS OTHERWISE SPECIFIED
The Bendix Corporation
Electrical Components Division
Sidney, New York
LAYOUT OF TERMINAL WITH SELF-CONTAINED DIELECTRIC RETENTION CLIP, SIZE 22
D 77820 L-27758-9
NEXT ASSEMBLY

Figure 12.

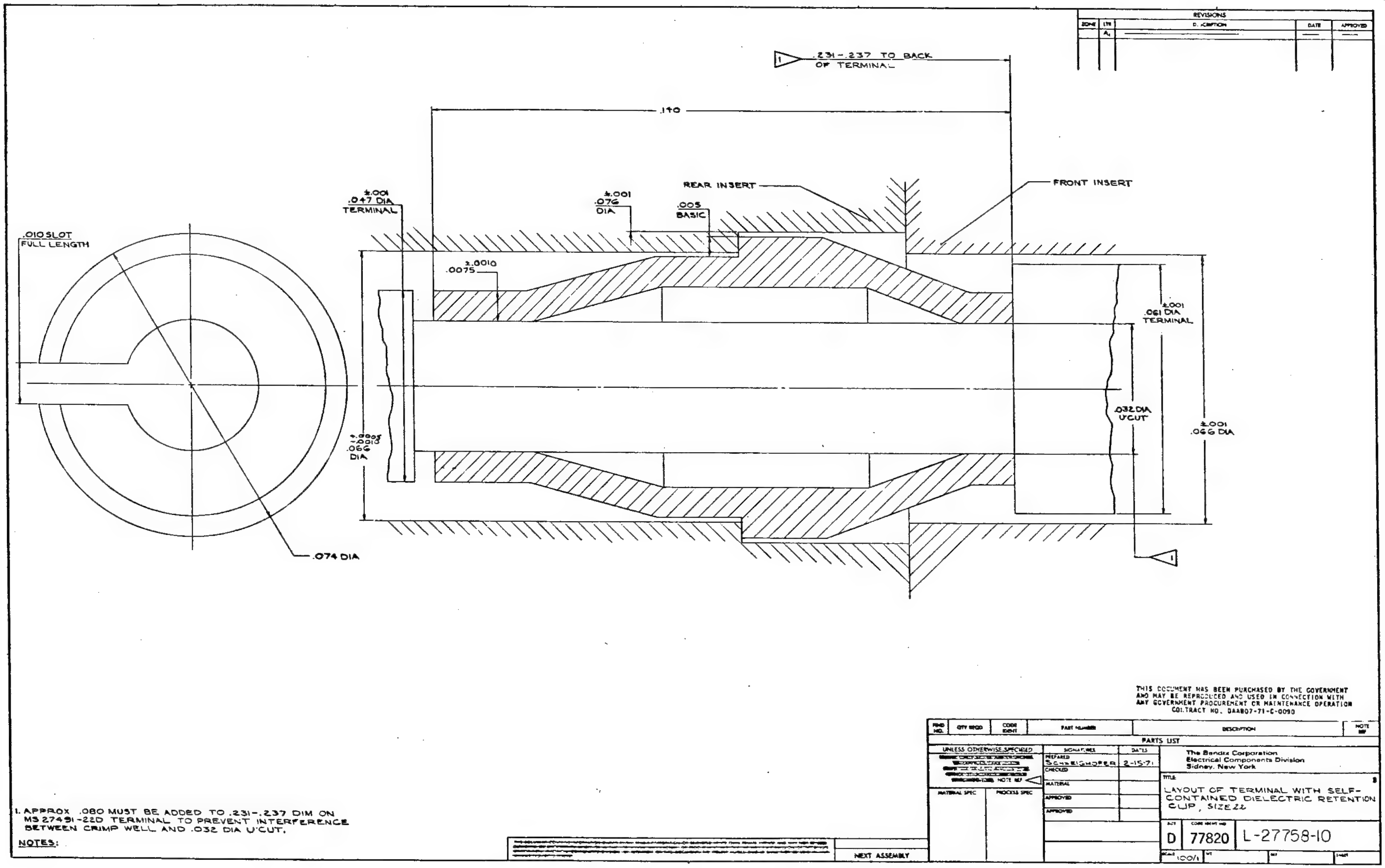

REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVED
.231-.237 TO BACK OF TERMINAL
.140
REAR INSERT
FRONT INSERT
±.001 .047 DIA TERMINAL
±.001 .076 DIA
.005 BASIC
.010 SLOT FULL LENGTH
±.0010 .0075
±.001 .061 DIA TERMINAL
.032 DIA U'CUT
±.001 .066 DIA
+.0005 -.0010 .066 DIA
.074 DIA
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
PARTS LIST
UNLESS OTHERWISE SPECIFIED
SIGNATURES
DATES
PREPARED
SCHNEIGHOFER
2-15-71
CHECKED
MATERIAL
APPROVED
MATERIAL SPEC
PROCESS SPEC
The Bendix Corporation
Electrical Components Division
Sidney, New York
TITLE
LAYOUT OF TERMINAL WITH SELF-CONTAINED DIELECTRIC RETENTION CLIP, SIZE 22
D
77820
L-27758-10
100/1
NEXT ASSEMBLY
1. APPROX .080 MUST BE ADDED TO .231-.237 DIM ON MS 27491-22D TERMINAL TO PREVENT INTERFERENCE BETWEEN CRIMP WELL AND .032 DIA U'CUT.
NOTES:

Figure 13.

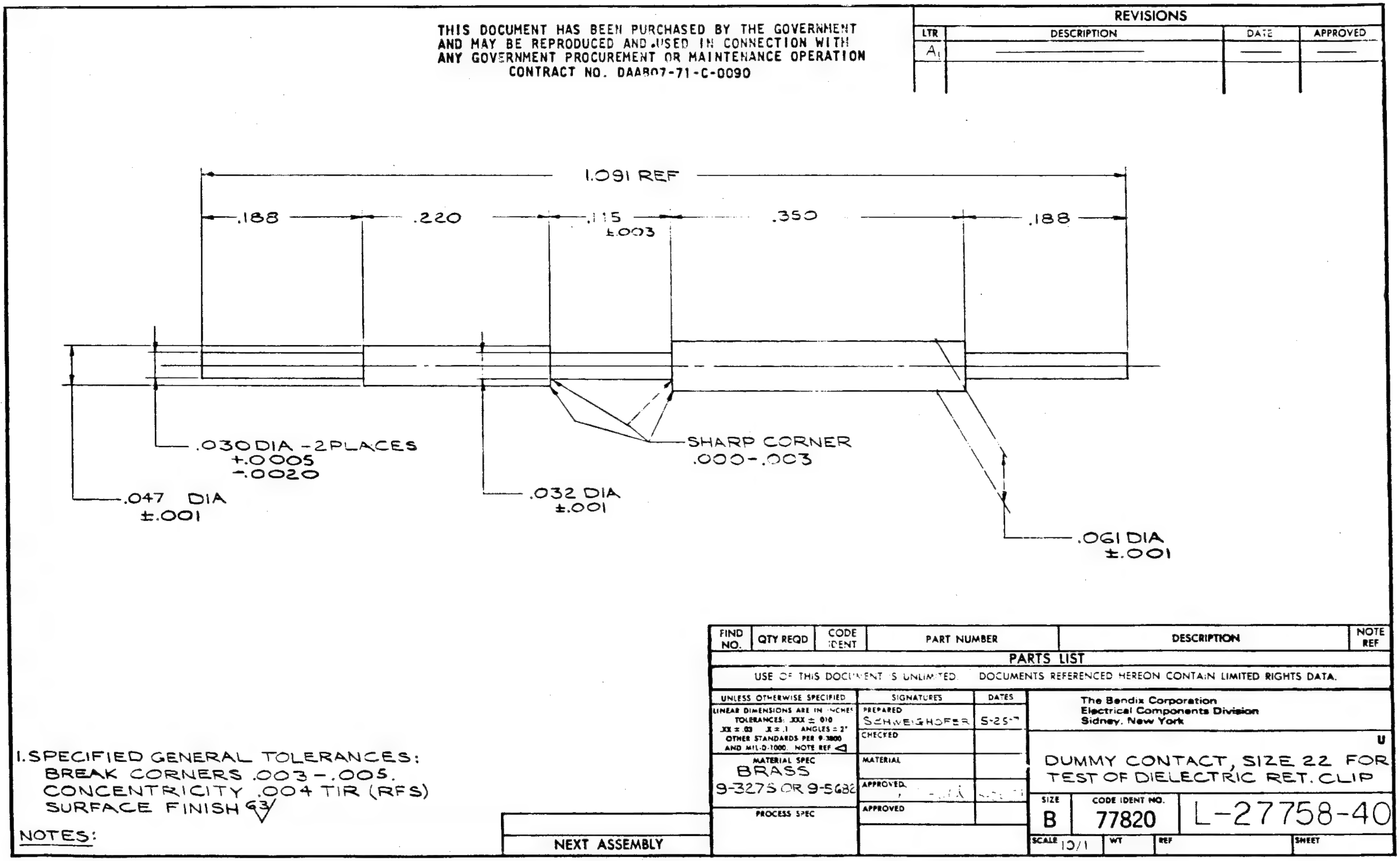

THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT
AND MAY BE REPRODUCED AND USED IN CONNECTION WITH
ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION
CONTRACT NO. DAAB07-71-C-0090
REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
A
1.091 REF
.188
.220
.115
±.003
.350
.188
.030 DIA -2 PLACES
+.0005
-.0020
.047 DIA
±.001
.032 DIA
±.001
SHARP CORNER
.000-.003
.061 DIA
±.001
1. SPECIFIED GENERAL TOLERANCES:
BREAK CORNERS .003-.005.
CONCENTRICITY .004 TIR (RFS)
SURFACE FINISH 63
NOTES:
NEXT ASSEMBLY
FIND NO.
QTY REQD
CODE IDENT
PART NUMBER
DESCRIPTION
NOTE REF
PARTS LIST
USE OF THIS DOCUMENT IS UNLIMITED. DOCUMENTS REFERENCED HEREON CONTAIN LIMITED RIGHTS DATA.
UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES
TOLERANCES: .XXX ± .010
.XX ± .03 .X ± .1 ANGLES ± 2°
OTHER STANDARDS PER 9-3800
AND MIL-D-1000. NOTE REF
MATERIAL SPEC
BRASS
9-3275 OR 9-5632
PROCESS SPEC
SIGNATURES
DATES
PREPARED
SCHWEIGHOFER
5-25-
CHECKED
MATERIAL
APPROVED
APPROVED
The Bendix Corporation
Electrical Components Division
Sidney, New York
U
DUMMY CONTACT, SIZE 22 FOR
TEST OF DIELECTRIC RET. CLIP
SIZE
B
CODE IDENT NO.
77820
L-27758-40
SCALE 10/1
WT
REF
SHEET

Figure 14.

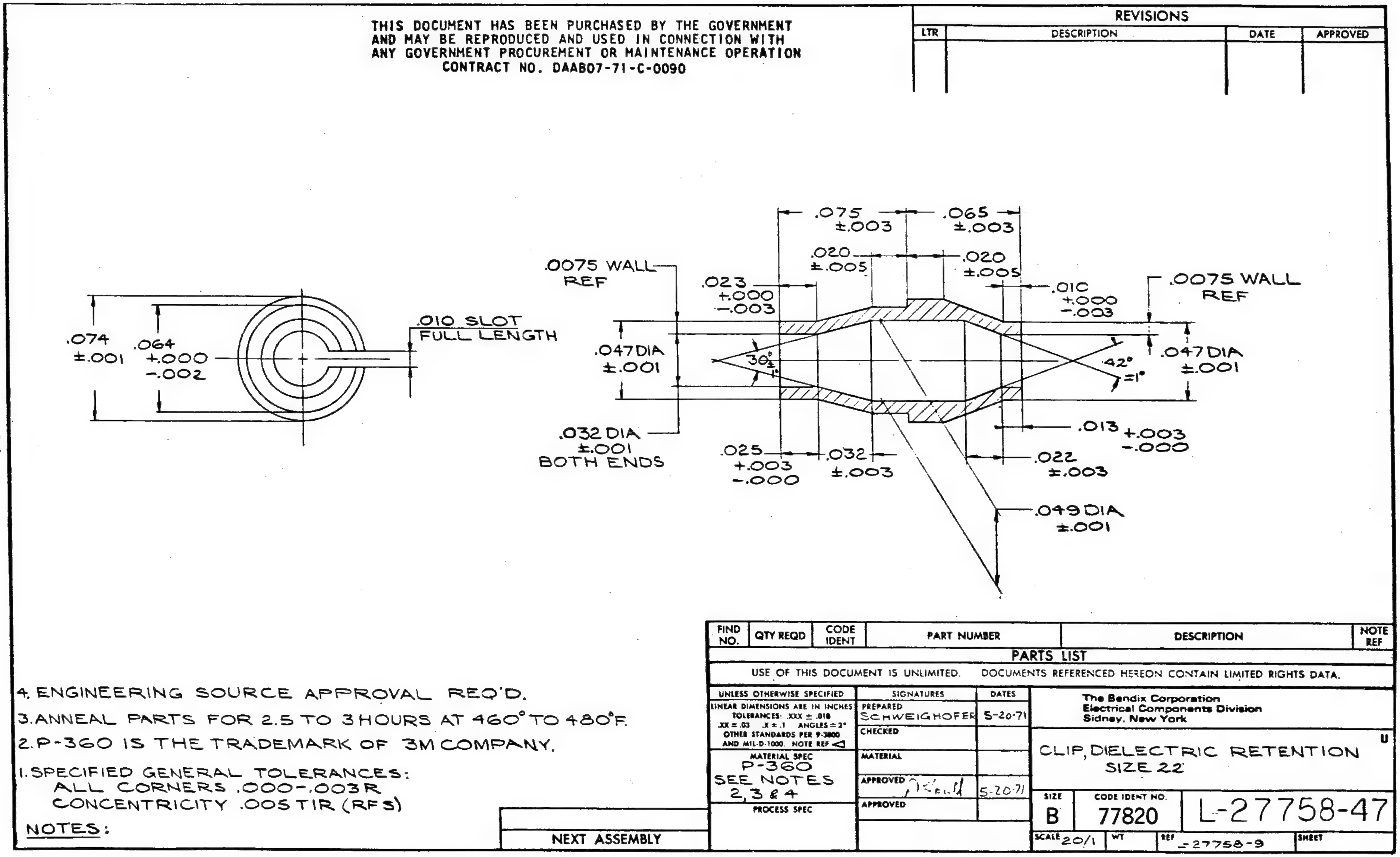
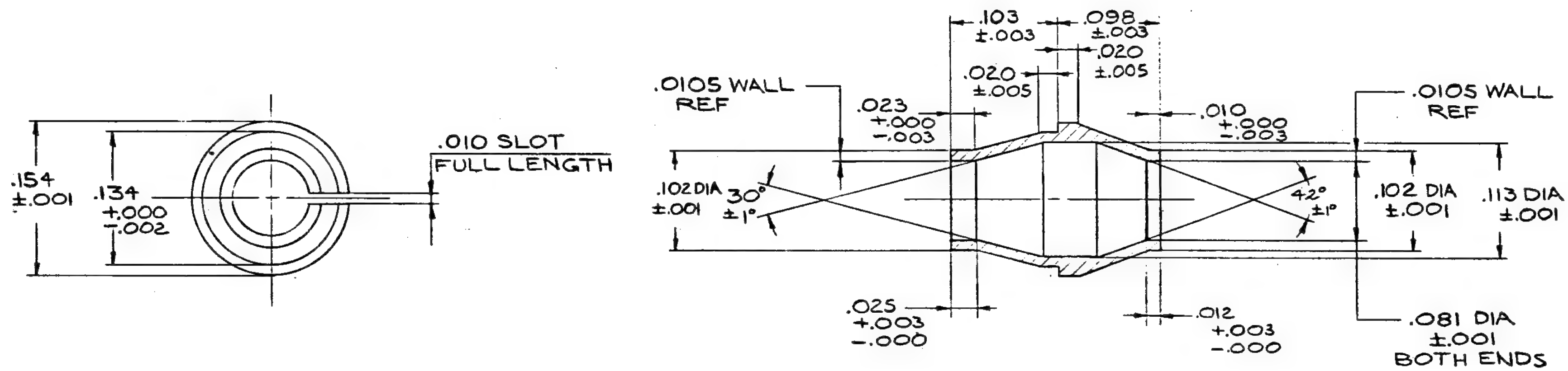

THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION
CONTRACT NO. DAAB07-71-C-0090
REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
.074 ±.001
.064 +.000 -.002
.010 SLOT FULL LENGTH
.0075 WALL REF
.047 DIA ±.001
.032 DIA ±.001 BOTH ENDS
.023 +.000 -.003
.075 ±.003
.020 ±.005
.065 ±.003
.020 ±.005
.010 +.000 -.003
.0075 WALL REF
.047 DIA ±.001
42° ±1°
.013 +.003 -.000
.022 ±.003
.049 DIA ±.001
.025 +.003 -.000
.032 ±.003
4. ENGINEERING SOURCE APPROVAL REQ'D.
3. ANNEAL PARTS FOR 2.5 TO 3 HOURS AT 460° TO 480°F.
2. P-360 IS THE TRADEMARK OF 3M COMPANY.
1. SPECIFIED GENERAL TOLERANCES:
ALL CORNERS .000-.003R
CONCENTRICITY .005 TIR (RFS)
NOTES:
NEXT ASSEMBLY
FIND NO.
QTY REQD
CODE IDENT
PART NUMBER
DESCRIPTION
NOTE REF
PARTS LIST
USE OF THIS DOCUMENT IS UNLIMITED. DOCUMENTS REFERENCED HEREON CONTAIN LIMITED RIGHTS DATA.
UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES
TOLERANCES: .XXX ± .010 .XX ± .03 .X ± .1 ANGLES ± 2°
OTHER STANDARDS PER 9-3800 AND MIL-D-1000. NOTE REF
MATERIAL SPEC
P-360
SEE NOTES 2, 3 & 4
PROCESS SPEC
SIGNATURES
DATES
PREPARED SCHWEIGHOFER 5-20-71
CHECKED
MATERIAL
APPROVED 5-20-71
APPROVED
The Bendix Corporation
Electrical Components Division
Sidney, New York
CLIP, DIELECTRIC RETENTION
SIZE 22
U
SIZE B
CODE IDENT NO. 77820
L-27758-47
SCALE 20/1
WT
REF -27758-9
SHEET

Figure 15.

REL NO.		REVISIONS		
CHG NO.	SYM	DESCRIPTION	DATE	APPROVED
—	A1	—	—	—



THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090

NOTES:

1. SPECIFIED GENERAL TOLERANCES:
   ALL CORNER .000-.003R
   CONCENTRICITY .005 TIR (RFS)
2. ANNEAL PARTS FOR 2.5 TO 3 HOURS AT 460° TO 480°F.
3. ENGINEERING SOURCE APPROVAL REQ'D.

ITEM	QTY REQD	PART NUMBER	DESCRIPTION		NOTE

PARTS LIST

USE OF THIS DOCUMENT IS UNLIMITED. DOCUMENTS REFERENCED HEREON CONTAIN LIMITED RIGHTS DATA.

UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES
TOLERANCES: .XXX ± .010 .XX ± .03 .X ± .1 ANGLES ± 2°
OTHER STANDARDS PER 9-3800 AND MIL-STD-8. NOTE REF ◁

MATERIAL SPEC
MOLDING COMPOUND
9-6830
SEE NOTE 3

PROCESS SPEC

DRAWN: SCHWEIGHOFER DATE: 0-29-71
CHECKED: DATE:
MATERIAL:
STANDARDS:
DRAFTING:
ENGINEERING: 11-2-71

THE Bendix CORPORATION
ELECTRICAL COMPONENTS DIVISION
SIDNEY, NEW YORK, U.S.A.

CLIP, DIELECTRIC RETENTION, SIZE 16

U

SIZE B | CODE IDENT NO. 77820 | L-27758-108

SCALE 10/1 | WT | REF | SHEET

NEXT ASSEMBLY

Figure 16.

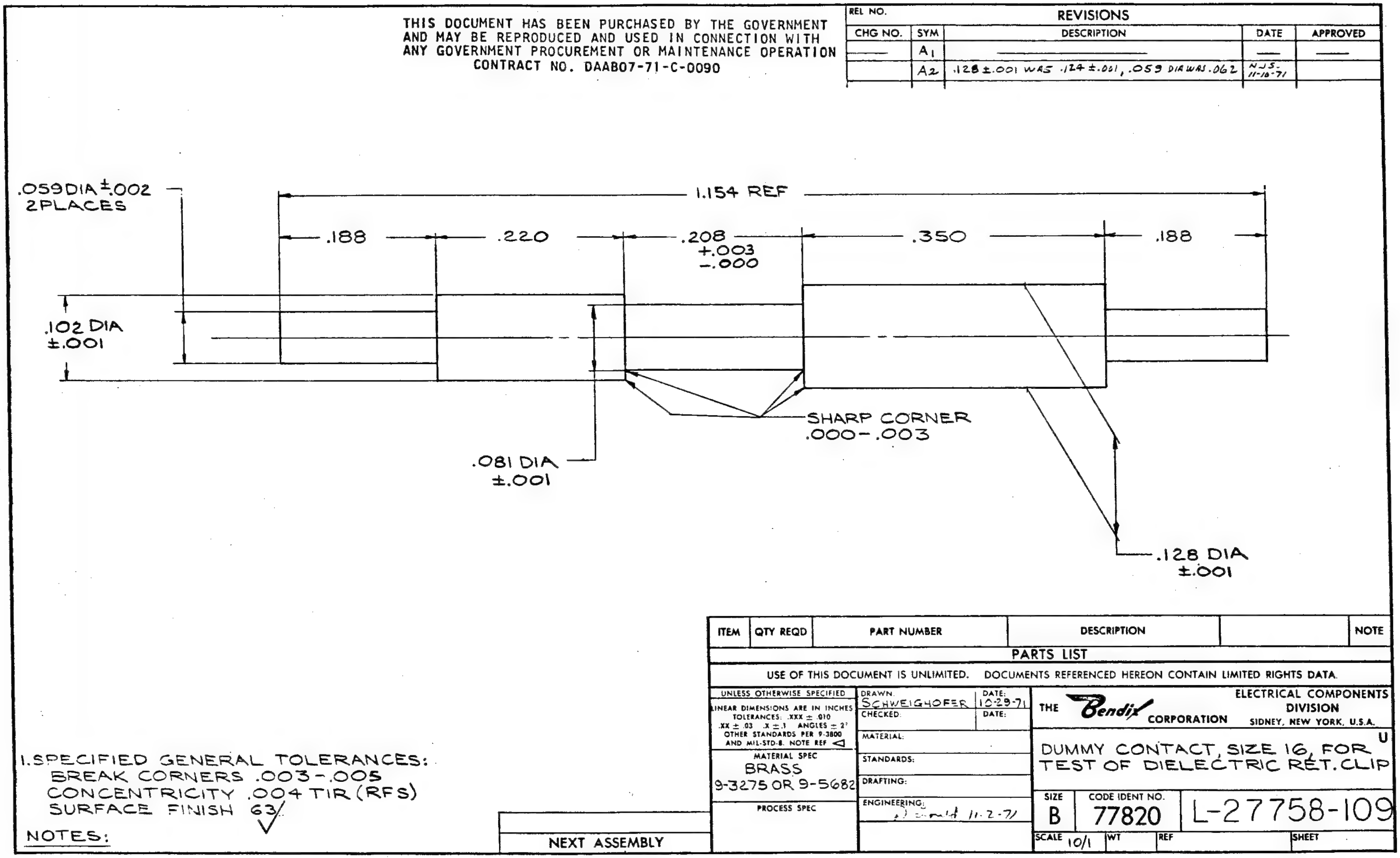

THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION
CONTRACT NO. DAAB07-71-C-0090
REL NO.
REVISIONS
CHG NO.
SYM
DESCRIPTION
DATE
APPROVED
A1
A2
.128±.001 WAS .124±.001, .059 DIA WAS .062
NJS. 11-16-71
.059 DIA ±.002
2 PLACES
1.154 REF
.188
.220
.208
+.003
-.000
.350
.188
.102 DIA
±.001
SHARP CORNER
.000-.003
.081 DIA
±.001
.128 DIA
±.001
ITEM
QTY REQD
PART NUMBER
DESCRIPTION
NOTE
PARTS LIST
USE OF THIS DOCUMENT IS UNLIMITED. DOCUMENTS REFERENCED HEREON CONTAIN LIMITED RIGHTS DATA.
UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES
TOLERANCES: .XXX ± .010
.XX ± .03 .X ± .1 ANGLES ± 2°
OTHER STANDARDS PER 9-3800
AND MIL-STD-8. NOTE REF
MATERIAL SPEC
BRASS
9-3275 OR 9-5682
PROCESS SPEC
DRAWN:
SCHWEIGHOFER
DATE:
10-29-71
CHECKED:
DATE:
MATERIAL:
STANDARDS:
DRAFTING:
ENGINEERING:
11-2-71
THE Bendix CORPORATION
ELECTRICAL COMPONENTS DIVISION
SIDNEY, NEW YORK, U.S.A.
U
DUMMY CONTACT, SIZE 16, FOR TEST OF DIELECTRIC RET. CLIP
SIZE
B
CODE IDENT NO.
77820
L-27758-109
SCALE
10/1
WT
REF
SHEET
1. SPECIFIED GENERAL TOLERANCES:
BREAK CORNERS .003-.005
CONCENTRICITY .004 TIR (RFS)
SURFACE FINISH 63
NOTES:
NEXT ASSEMBLY

Figure 17.

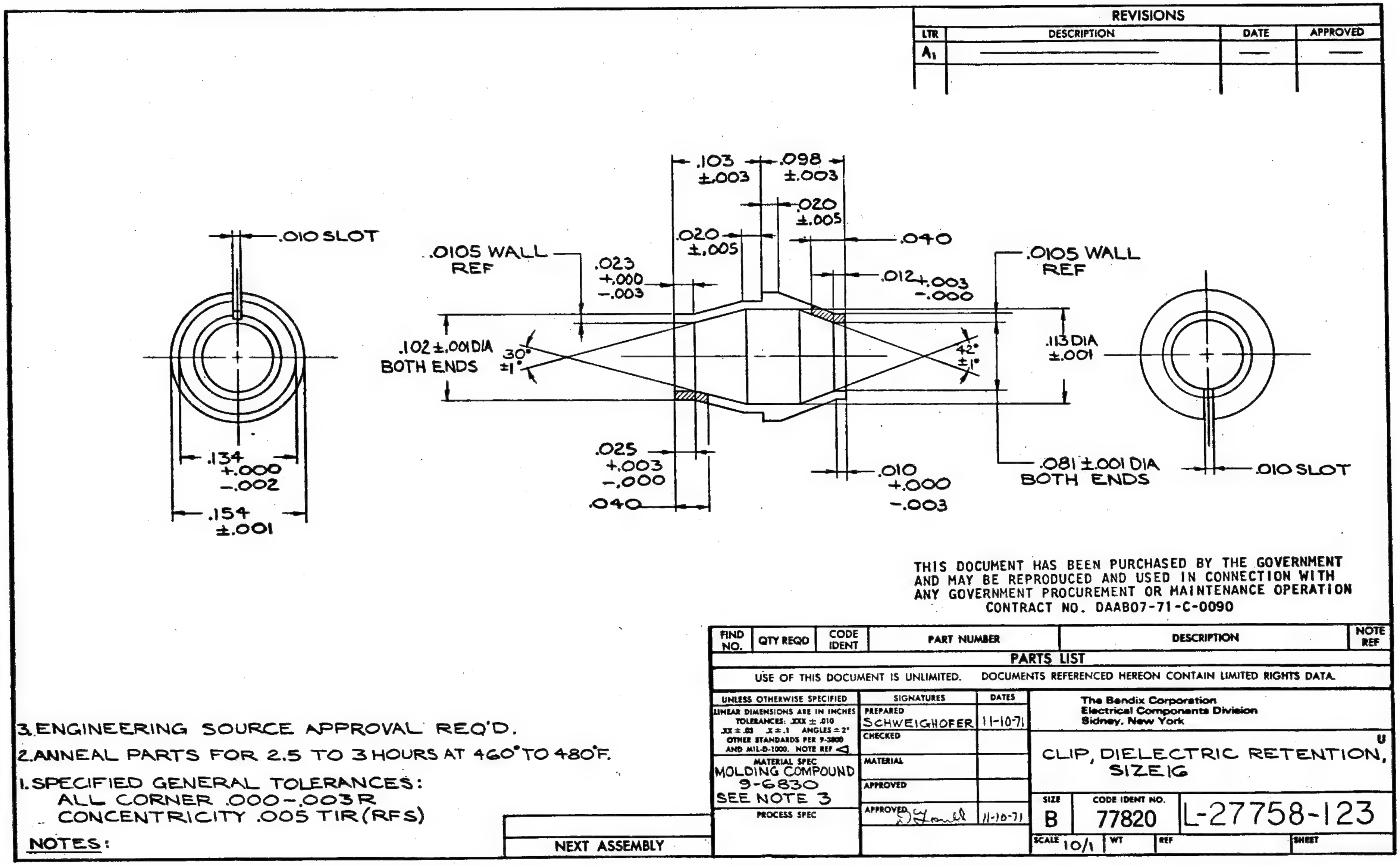

REVISIONS
LTR DESCRIPTION DATE APPROVED
A1
.010 SLOT
.134 +.000 -.002
.154 ±.001
.0105 WALL REF
.102±.001 DIA BOTH ENDS
30° ±1°
.023 +.000 -.003
.025 +.003 -.000
.040
.103 ±.003
.098 ±.003
.020 ±.005
.020 ±.005
.040
.012 +.003 -.000
.010 +.000 -.003
42° ±1°
.0105 WALL REF
.113 DIA ±.001
.081 ±.001 DIA BOTH ENDS
.010 SLOT
THIS DOCUMENT HAS BEEN PURCHASED BY THE GOVERNMENT AND MAY BE REPRODUCED AND USED IN CONNECTION WITH ANY GOVERNMENT PROCUREMENT OR MAINTENANCE OPERATION CONTRACT NO. DAAB07-71-C-0090
FIND NO. QTY REQD CODE IDENT PART NUMBER DESCRIPTION NOTE REF
PARTS LIST
USE OF THIS DOCUMENT IS UNLIMITED. DOCUMENTS REFERENCED HEREON CONTAIN LIMITED RIGHTS DATA.
UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ARE IN INCHES TOLERANCES: .XXX ± .010 .XX ± .03 .X ± .1 ANGLES ± 2° OTHER STANDARDS PER 9-3800 AND MIL-D-1000. NOTE REF
MATERIAL SPEC MOLDING COMPOUND 9-6830 SEE NOTE 3
PROCESS SPEC
SIGNATURES DATES
PREPARED SCHWEIGHOFER 11-10-71
CHECKED
MATERIAL
APPROVED
APPROVED 11-10-71
The Bendix Corporation
Electrical Components Division
Sidney, New York
CLIP, DIELECTRIC RETENTION, SIZE 16
SIZE B CODE IDENT NO. 77820 L-27758-123
SCALE 10/1 WT REF SHEET
3. ENGINEERING SOURCE APPROVAL REQ'D.
2. ANNEAL PARTS FOR 2.5 TO 3 HOURS AT 460° TO 480°F.
1. SPECIFIED GENERAL TOLERANCES:
ALL CORNER .000-.003R
CONCENTRICITY .005 TIR (RFS)
NOTES:
NEXT ASSEMBLY

Figure 18.

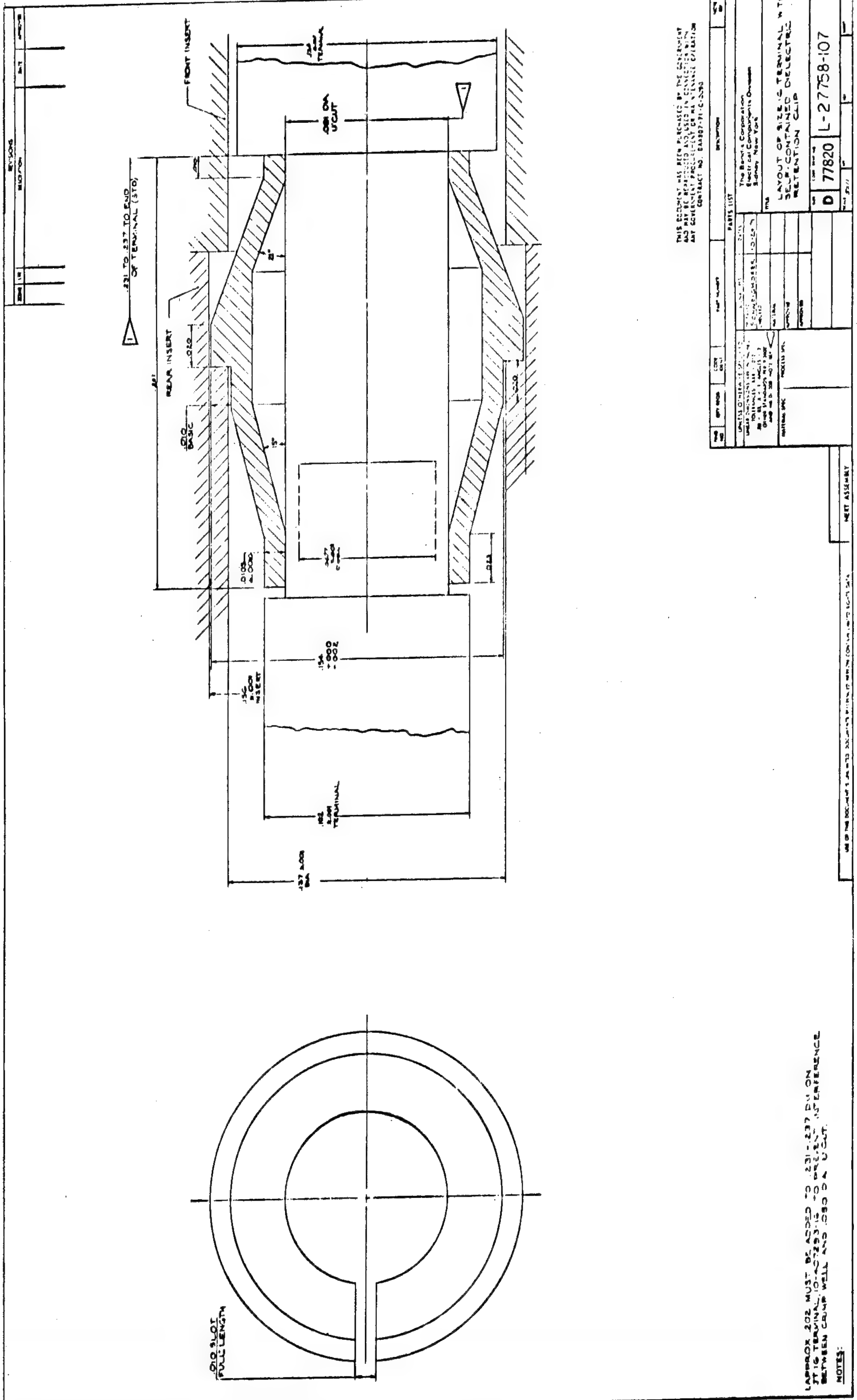

FRONT INSERT
REAR INSERT
LAYOUT OF SIZE 16 TERMINAL WITH SELF-CONTAINED DIELECTRIC RETENTION CLIP
D 77820 L-27758-107
NOTES:

Figure 19.

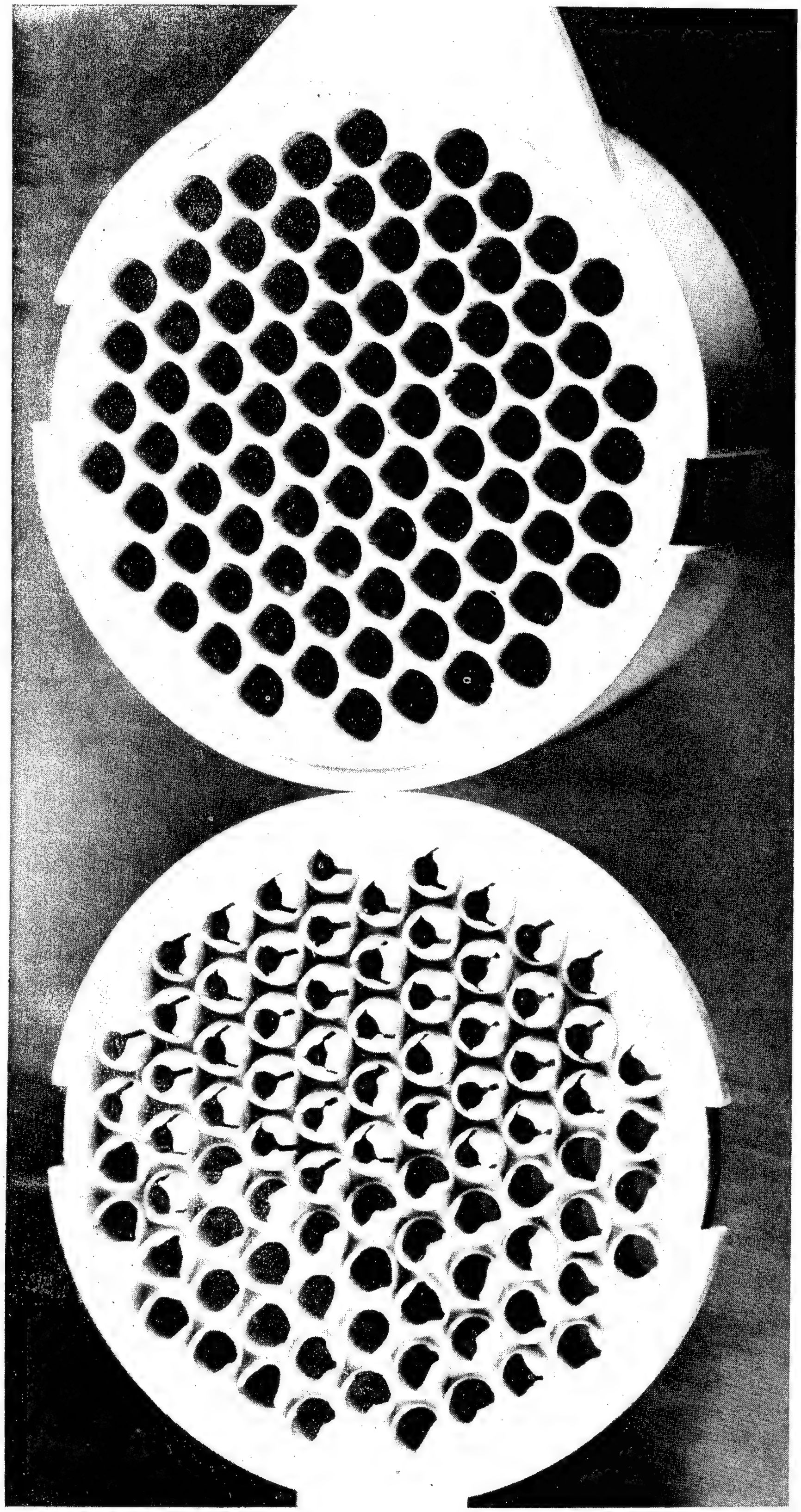


Figure 20. 18-85 Arrangement Dielectric Terminal Retention.

Figure 21. 18-85 Arrangement Metallic Terminal Retention.

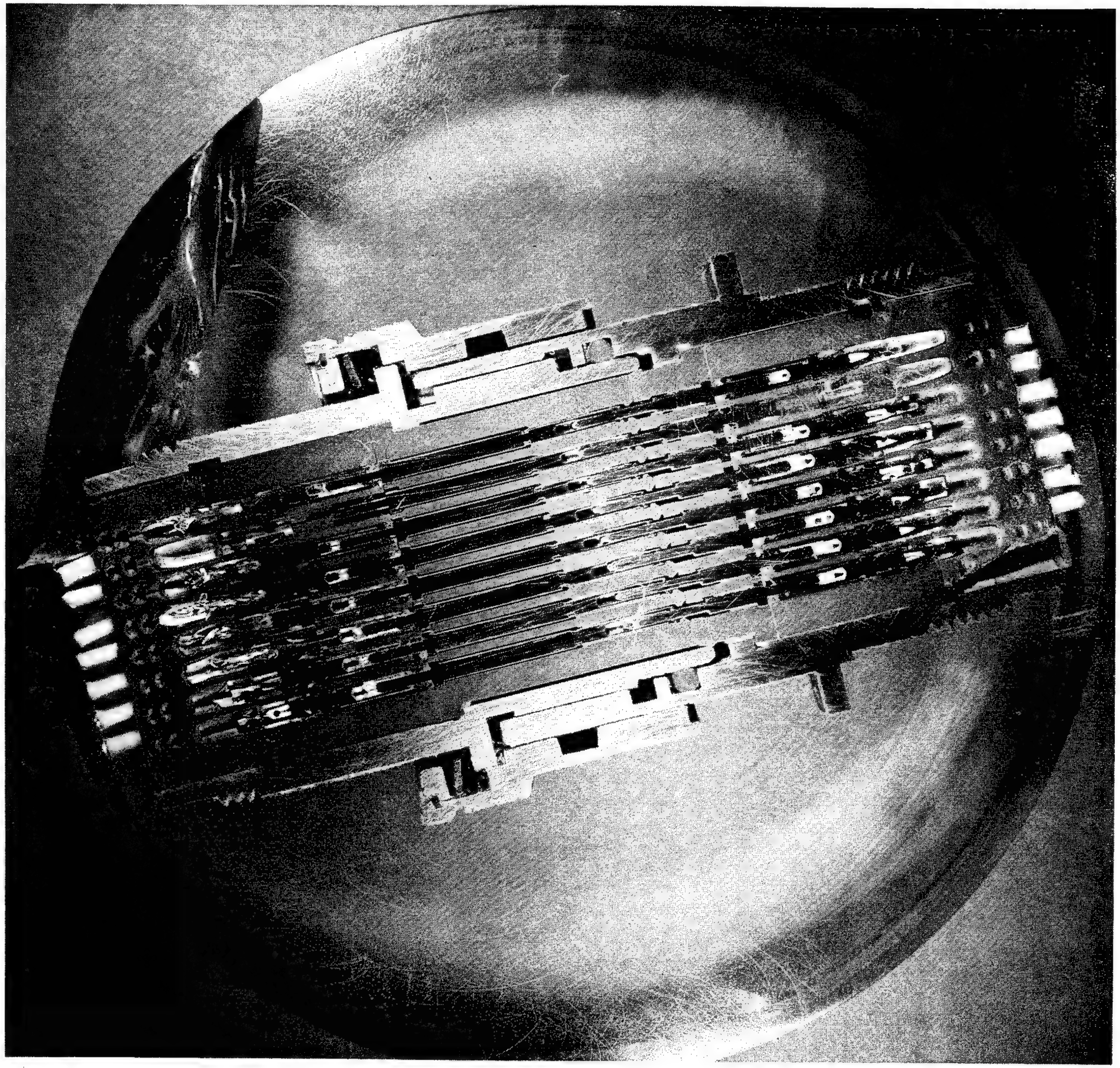


Figure 22.

18-85 Arrangement Metallic Retention Assembly Cutaway.

Figure 23. 22-55 Arrangement Dielectric Retention Assembly.

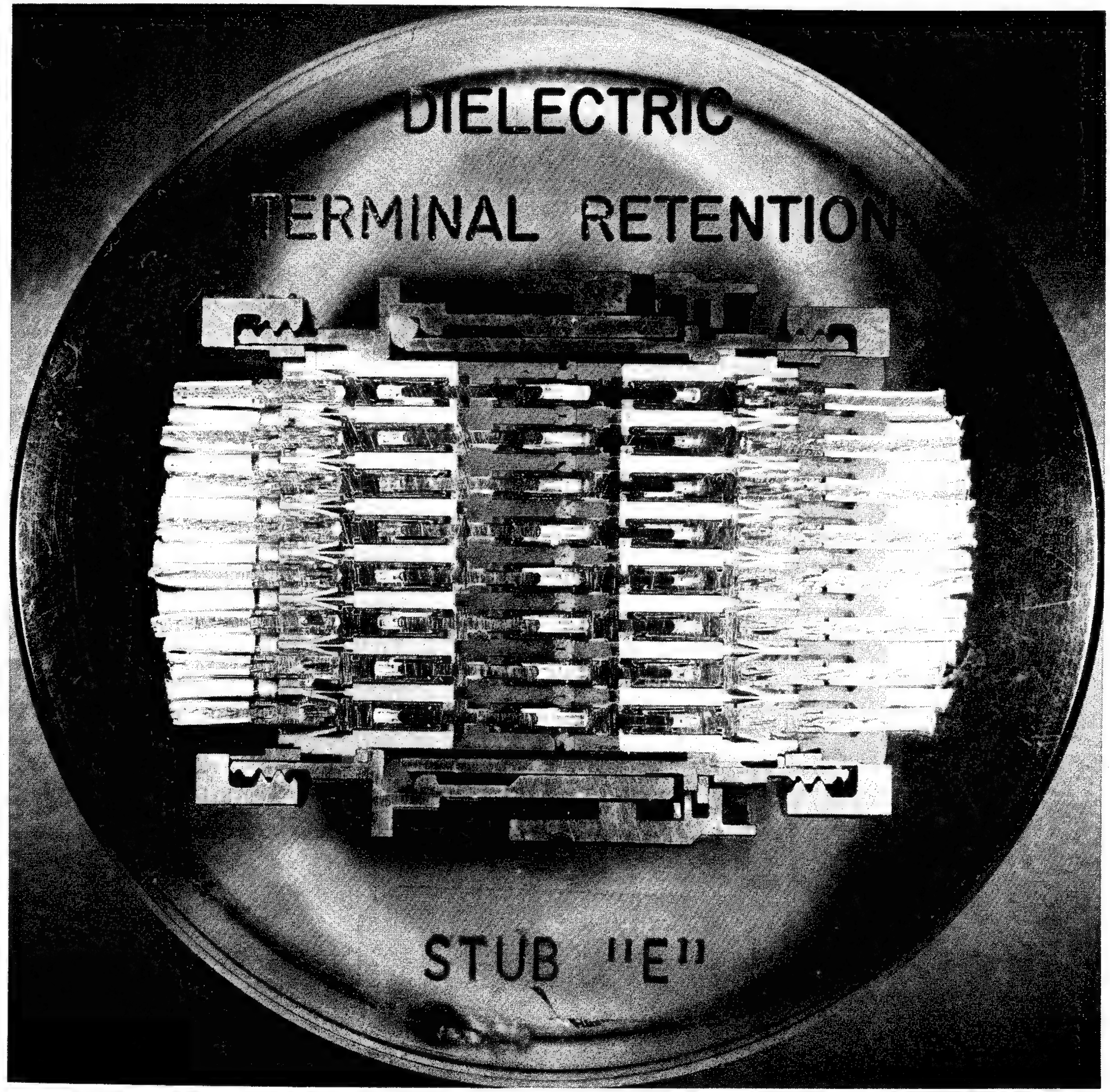


Figure 24.
22-55 Arrangement
Dielectric
Retention Cutaway

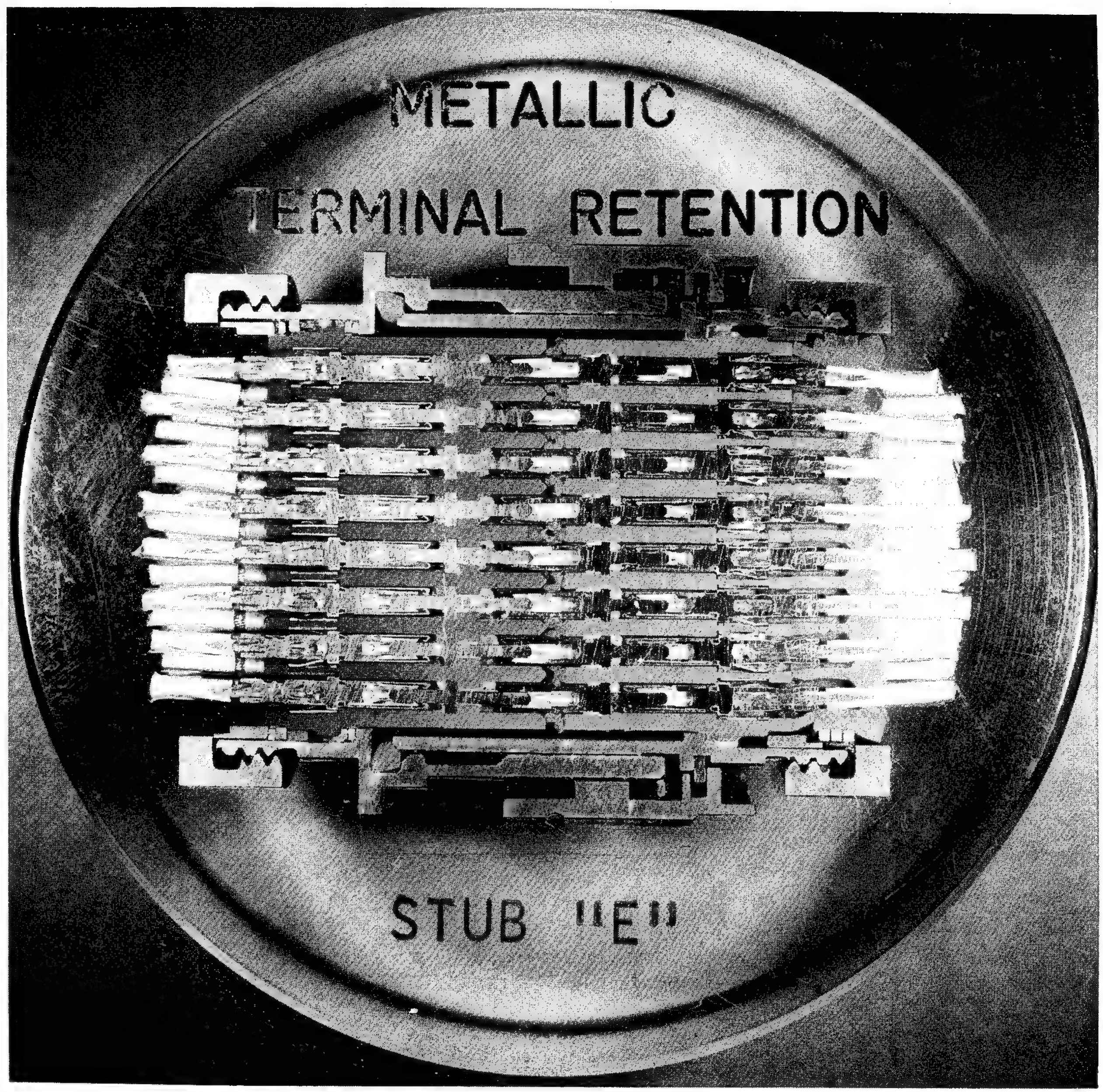


Figure 25.

22-55 Arrangement Metallic Retention Cutaway.

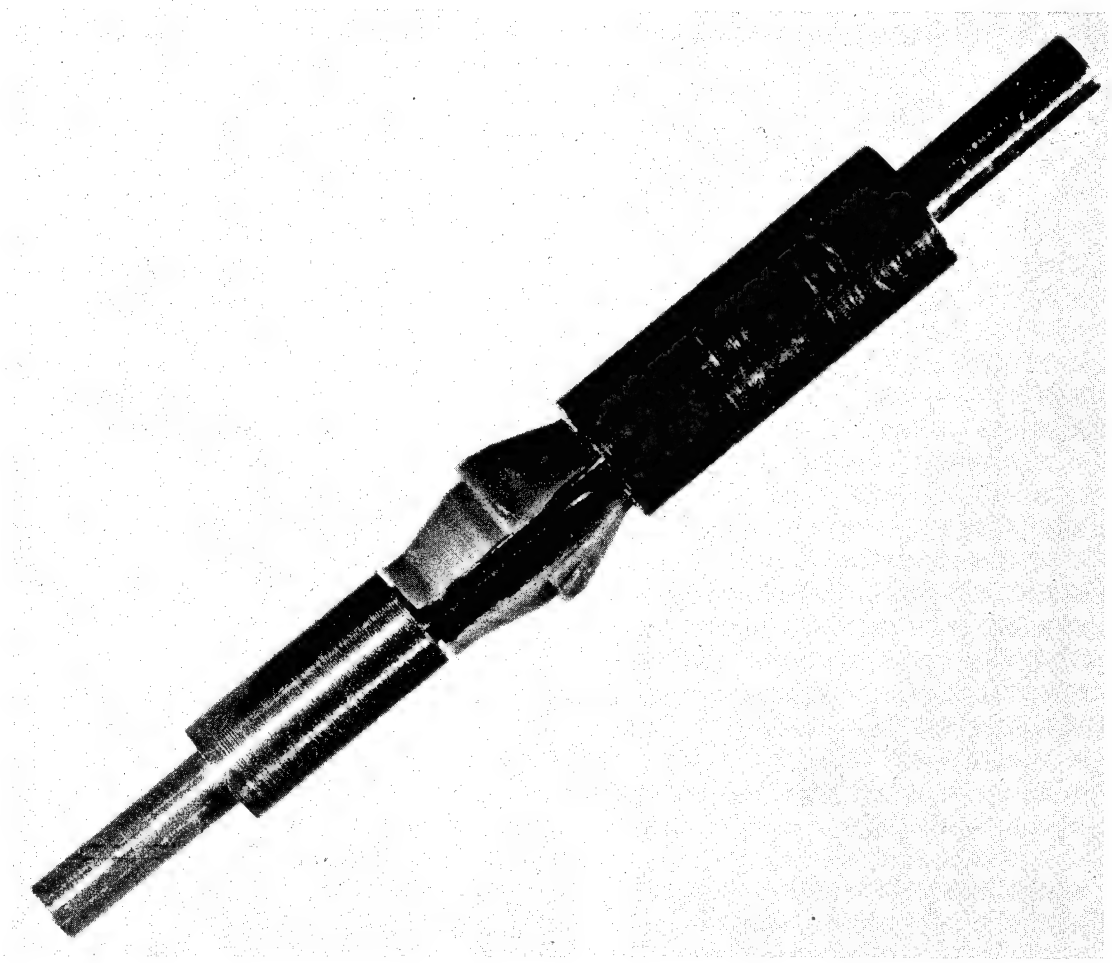


Figure 26. Enlarged View - Contact with Dielectric Retention.

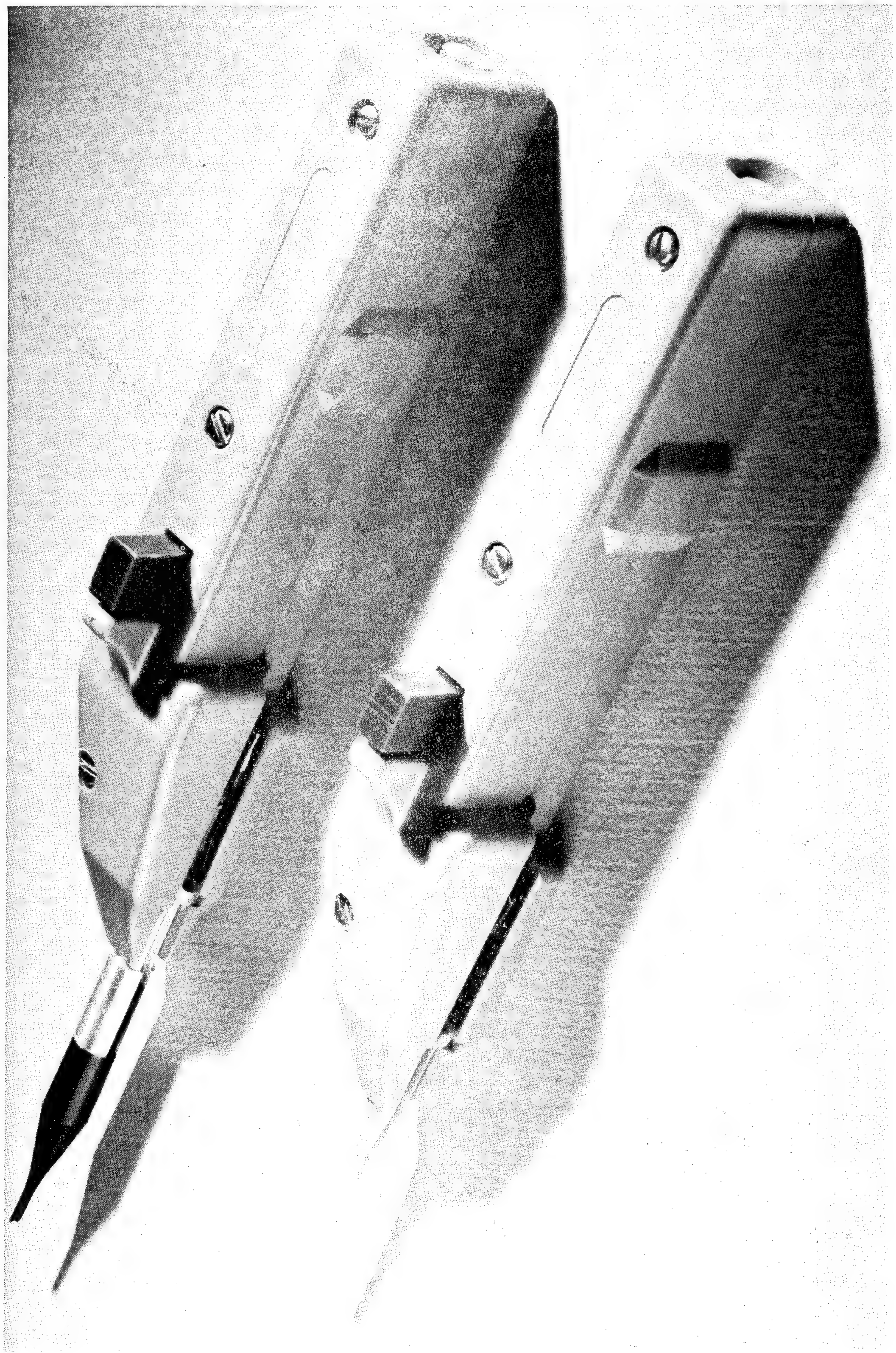


Figure 27. Burndy Contact Insertion Tools.

APPENDIX

Engineering Laboratory Report 12-5193

Engineering Laboratory Report 12-5194

Engineering Laboratory Report 12-5204

Internal Memorandum T73-35

Battelle Letter to USAECOM March 17, 1972

Distribution List

Form DD 1473

Engineering Laboratory Report

12-5193

PRE PRODUCTION TESTING, BENDIX PROTOTYPE

MIL-C-81511 TYPE, INTEGRATED WIRE

TERMINATION DEVICES

DATE OF TESTS: 6 JUNE 72 TO 5 JULY 72

DATE OF REPORT: 2 February 1973

REPORTED BY: Walter E. Denny

APPROVED BY: Lewis D. Armitage

APPROVED BY: David C Baker

NOTED BY: Donald H. Gould

NOTED BY: Donald L. Pfendler

Bendix Electrical Components Division

Sidney, N.Y. 13838

TABLE OF CONTENTS page

I PURPOSE OF TEST 1

II CONCLUSIONS 1

III RECOMMENDATIONS..1

IV ACTION TAKEN..1,2

V DETAILED REPORT

a) Test Samples, Test Sequence, Sample Preparation..............3,4,5
b) Examination of Product....................................5
c) Operating Forces....................................5
d) Insulation Resistance....................................5
e) Dielectric Withstanding Voltage....................................5
f) Contact Retention 6
g) Maintenance Age -Group I....................................6
h) Contact Retention -Group I....................................6,7
i) Thermal Shock -Group I and II....................................7

VI REFERENCES

VII APPENDICIES

a) L-15081-98 Test Procedure
b) Data Sheets

I PURPOSE

To qualify Bendix L-27758-24/25 MIL-C-81511 type electrical connectors, modified for inclusion of the Integrated Wire Termination system. This evaluation was made for assurance that this termination system would meet the applicable requirements of MIL-C-81511B as was set forth by the USAECOM Contract DAAB07-71-C-0090.

II CONCLUSIONS

1. The submitted connectors did not meet the requirement set forth in L-15081-98 specification.

2. Only minor discrepancies were noted in the initial examination such as excessive RTV filler, chipped inserts and poor alignment of the interfaces.

3. Five of the six connector pairs submitted for testing had two or more circuit failures during the initial dielectric withstanding voltage test.

4. One retention mechanism in each of two connector halves failed to retain the special test contact within the .012 inch displacement requirement while at load.

5. High insertion and removal forces were encountered during the maintenance aging test, therefore, causing tool problems and grommet sealing web destructions.

III RECOMMENDATIONS

1. A fixture should be made to pre-electric test all connector components and sandwich assemblies. This would eliminate the loss of the fully assembled connectors and could help to pin point the cause of the failures.

2. More care should be taken in the assembling of the connectors to cut down the excessive amount of RTV filler compound.

IV ACTION TAKEN

The assemblies containing failures occurring during contact retention and dielectric withstanding voltage tests were disassembled to determine the cause of failure with the following observations and corrective action.

1. OBSERVATIONS
   A. Contact Retention
      a. One contact retention failure (terminal retention) (receptacle 58-24/5) was due to a burr on the rear of the clip that did not allow the clip to "seat" properly in its undercut.
      b. The second contact retention failure (terminal retention) was due to a porous molded rear shoulder in the clip retaining undercut in the insert.

2. DIELECTRIC WITHSTANDING VOLTAGE

a) All of the dielectric withstanding voltage test failures were through a porous area between two adjacent holes at the undercut in the insert that retains the terminal retention clip.

B. CORRECTIVE ACTION

1. Contact Retention
   a) The corrective action for the one contact retention failure due to the burr on the clip would be equipment to cut off the clips from the selvage to eliminate the burr that may have occurred when the clips were broken off the selvage.

   b) The corrective action for the contact retention failure caused by the porous molding that failed to retain the contact retention clip can only be to improve the quality of the moldings.

2. DIELECTRIC WITHSTANDING VOLTAGE

a) During a conference attended by USAECOM and Bendix-ECD personnel, it was decided that a separate program would be started to investigate throughly the capability to produce mechanically and electrically sound inserts. The best of production techniques in molding procedures are to be employed. Also, additional molding compounds are to be investigated if necessary. The results of the program will be reported at a later date.

Donald H. Gould

Donald Gould
Connector Engineering

V DETAILED REPORT

A total of six mating pairs of L-27758-24 plug and L-27758-25 receptacle connectors were submitted for this test program. The connectors were individually numbered and divided into three groups. Group I consists of receptacles 1,2 and plug connectors 1,2. Group II consists of receptacles 3,4 and plug connectors 3,4. Group III consists of receptacles 5,6 and plug connectors 5,6. All these connectors had metallic retention mechanisms. All connectors were tested in accordance with Bendix test procedure L-15081-98, a copy of which is attached.

The connectors were subjected to the tests in the following sequence, in the order listed.

TEST	PARAGRAPH	TEST SAMPLE NUMBERS
Examination of Product	6.1	1,2,3,4,5,6
Operating Torques	6.3	1,2,3,4,5,6
Insulation Resistance	6.4	1,2,3,4,5,6

TEST	PARAGRAPH	TEST SAMPLE NUMBERS
Dielectric withstanding Voltage	6.5	1,2,3,4,5,6
Contact Retention (Fixed and Removable)	6.6	1,2,3,4,5,6
Maintenance Age	6.7	1,2
Contact Retention (Removable)	6.6.1	1,2
Thermal Shock	6.8	1,2,3,4
Vibration	6.9	1,2
Shock	6.10	1,2
Moisture Resistance	6.11	1,2
Dielectric withstanding Voltage (Altitude)	6.12	3,4
Insulation Resistance (Elevated Temperature)	6.13	3,4
Air Leakage	6.14	3,4
Water Immersion	6.15	3,4
Contact Resistance	6.16	1,2,3,4
Salt Spray	6.17	3,4
Operating Torque	6.3	1,2,3,4
Contact Resistance	6.16	3,4
Contact Retention	6.6	3,4
Durability	6.18	5,6
Temperature Life	6.19	1,2
Fluid Immersion (Lube Oil)	6.20.1	1,2
" " (Hydraulic Fluid)	6.20.2	3,4
Operating Torques	6.3	1,2,3,4,5,6
Insert Retention	6.21	1,2
Dielectric withstanding Voltage	6.5	5,6
Contact Retention	6.6	5,6
Insulation Resistance	6.4	5,6
Dielectric withstanding Voltage (Altitude)	6.12	5,6
Contact Resistance	6.16	5,6
Examination of Product	6.22	1,2,3,4,5,6

Each socket termination was crimped to a three foot length of Teflon insulated wire and installed into the insert cavities. Samples 1,3,5 were wired with 28 gage MS21985 wire having an OD of approximately .038 inch. Samples 2,4,6 were wired with 22 gage MS 21985 wire having an OD of approximately .052 inch. The socket terminations were crimped to the wire's using the M22520/2-01 crimp tool.

EXAMINATION OF PRODUCT - Para 6.1 (ALL SAMPLES)

All connector halves, and components were visually examined for conformance to the applicable Bendix assembly drawings, identification and general quality of workmanship. Some minor descrepancies such as excessive RTV filler, chipped insert edges, poor interface alignment and small nicks in grommets were noted, but no major descrepancies were noted during the visual examination.

All the minor defects could be and should be easily remedied.

OPERATING TORQUES - Para. 6.3 (ALL SAMPLES)

Each plug was coupled and uncoupled with its counterpart receptacle at a slow uniform rate. The peak torques were measured using a torque wrench and appropriate fixture. All torques, both coupling and uncoupling, were within the specification limits. Maximum torque was 15 1/2 in. lbs. and the minimum force was 7 3/4 in. lbs. Precise data is on the included data sheet ECL0540A4.

INSULATION RESISTANCE - Para. 6.4 (ALL SAMPLES)

The insulation resistance of the mated connectors was measured between each of twelve contacts and all other contacts and shell tied electrically in common. Six of the contacts were adjacent to the shell. The measurements were made at a test potential of 500 Volts DC and the electrification time did not exceed 2 minutes per circuit. All insulation resistance measurements exceeded the 5,000 megohms minimum allowed by the specification. Precise data can be obtained from the included data sheet ECL0540A-5 thru 10.

DIELECTRIC WITHSTANDING VOLTAGE - Para. 6.5 (ALL SAMPLES)

The mated connectors had potential of 1300 Volts AC/RMS 60 Hz applied between each contact and all the contacts and shell tied electrically in common for a time period of 2 seconds per circuit. Any electrical breakdown, flashover or leakage in excess of 1 ma was considered facture. Five of the six mating pairs of connectors had two or more circuit failures. Further testing disclosed that the failures were not restricted to either the plug or receptacle.

Upon completion of the test program, the cause of the dielectric withstanding voltage failures was further investigated. It was found that in most cases the failures occurred between contacts in the thin wall section of the insert. This wall thickness being only .008 inch between contacts. Precise data can be obtained from the included data sheet ECL0540A-11-12.

CONTACT RETENTION - Para. 6.6 (ALL SAMPLES)

Removable contacts

Fifteen contacts, randomly selected, were removed and replaced with a specially made test contact for contact retention. The special contact incorporated its own retention member release sleeve and had a "tail" long enough to allow the load to be applied.

A load (tensile) of 10 lbs. was applied at a rate of 1lb. per second and monitored for a time period of 5-10 seconds. Two retention mechanisms failed to hold the special contact during the load application. One failure was cavity 35 in receptacle #1, and cavity 22 in receptacle #5.

FIXED CONTACTS

Fifteen fixed contacts, same contact numbers used above, in each connector half, had a load of 10 lbs. applied to their mating ends at a rate of approximately 1 lb. per second and monitored for a period of 5 to 10 seconds. None of the contacts displaced more than the .012 inch allowable by the specification. Maximum displacement was .008 inch. Precise data can be obtained from the included data sheets, ECL0540A-17 thru 25.

MAINTENANCE AGE - Para. 6.7 Group I

Each removable contact was removed from and re-inserted into the individual insert cavity using the 11-8674 insertion tool and 11-8675 removal tool. The fifteen contacts, previously used in contact retention test, was subjected to an additional 9 more insertions and removals. The forces required to insert and remove these contacts was measured on the 1st and 9th insertion and removal.

Although there is no specification limit, it was felt that the initial inserting and removal forces were too high. This caused tool problems which in turn damaged the sealing webs in the grommet. The MS 27509A22M and MS 27509R22M plastic insertion and removal tools would spread under the force and slip over the contact shoulders. The 11-8674 and 11-8675 metal tools would also spread and slip over the shoulders of the contacts which in turn would damage the sealing area of the grommets.

The forces were 2-4 lbs. higher than the forces obtained in the preliminary evaluation. Precise data can be obtained from the included data sheets ECL0540A-13 thru 16.

CONTACT RETENTION - Para. 6.6.1 (GROUP I)

Removable Contacts

The fifteen contacts, subjected to maintenance ageing were again subjected to the contact retention test. A load of 10 pounds was

again applied to the special test contact, previously described, and held for a time period of 5 to 10 seconds. All retention mechanisms retained the special contact except for cavity #35 in receptacle #1, which had previously failed. This cavity, although not holding the special contact, does function mechanically with the standard contact and was used for further testing. Precise data can be obtained from the included data sheets ECL0540A-26-27.

THERMAL SHOCK Para. 6.8 Group I and II

The unmated connectors were subjected to 5 continuous cycles of temperature shock. Each cycle consisted of 30 minutes at -65°C (-85°F) followed by 30 minutes at +175°C (+349°F) with less than 2 minutes elapsing between temperature extremes. Visual examination did not disclose any cracking or detrimental effects to the connectors or components.

By agreement between the Engineering Department of the Bendix Corporation and Mr. Ryan of the USAECOM, all testing on this type of connector was stopped due to the poor test results obtained. It was felt that due to the high amount of circuit failures in the dielectric withstanding voltage test, the high forces obtained in inserting the contacts and the destruction of the grommets due to the tool problem caused by these high forces, no further testing would be of any value.

REFERENCES CLT 3128 05971-02 and 74535
L-15081-98 NO REVISIONS
MIL-C-81511
MIL-C-38999
MIL-STD-202
ECL0540 and ECL0540A

Walter Denny
dl

APPENDICES A
L-15081-98

L-15081-98

PRE-PRODUCTION TESTING OF

INTEGRATED WIRE TERMINATION

SYSTEM ELECTRICAL CONNECTORS

FOR USAECOM

THE BENDIX CORPORATION
ELECTRICAL COMPONENTS DIVISION
SIDNEY, NEW YORK

1.0 Scope

The purpose of this test procedure is to establish the samples and test methods to be used in pre-production testing of MIL-C-81511B and "Stub-E" (Ordnance Document 11176551) type electrical connectors which are modified for inclusion of the Integrated Wire Termination System.

The test methods and limits contained herein were chosen as being applicable for these connector designs. They are derived essentially from the two documents referenced above.

2.0 Test Agency

All tests herein described will be performed at and by the Engineering Laboratory, Electrical Components Division, The Bendix Corporation, Sidney, New York 13838.

3.0 Standard Test Conditions

Unless otherwise specified, tests and examinations specified by this procedure will be conducted under any combination within the ranges below:

Temperature	68°F to 95°F
Relative Humidity	10% to 80%
Barometric Pressure	24" to 31" Hg

4.0 Test Samples

A total of 12 mating connectors will be required for this test program. They are identified as follows:

Test Sample No.	Type	Bendix Part No.	Shell Config.	Retention
1,2,3,4,5,6	81511	L-27758-24	Plug	Metallic
"	"	L-27758-25	Receptacle	"
7,8,9,10,11,12	Stub"E"	L-27758-104	Plug	Dielectric
"	"	L-27758-105	Receptacle	"

The MIL-C-81511 connectors have 85 Size 22D contacts, (18-85 arrangement), and the Stub "E" connectors have 55 Size 20 contacts (22-55 arrangement).

5.0 Test Sequence

The connectors shall be subjected to the tests in the following sequence in the order listed:

Test	Para.	Test Samples 1,2,7,8	3,4,9,10	5,6,11,12
Examination of Product	6.1	X	X	X
Wire & Prepare	6.2	X	X	X
Operating Torques	6.3	X	X	X
Insulation Resistance	6.4	X	X	X
Dielectric Withstanding Voltage	6.5	X	X	X
Contact Retention (Remov. & Fixed)	6.6	X	X	X
Maintenance Age	6.7	X		
Contact Retention (Remov. Only)	6.6.1	X		
Thermal Shock	6.8	X	X	
Vibration	6.9	X		
Shock	6.10	X		
Moisture Resistance	6.11	X		
Dielectric Withstanding Voltage (Alt.)	6.12		X	
Insulation Resistance (Elev. Temp.)	6.13		X	
Air Leakage	6.14		X	
Water Immersion	6.15		X	
Contact Resistance	6.16	X	X	
Salt Spray	6.17		X	
Operating Torques	6.3	X	X	
Contact Resistance	6.16		X	
Contact Retention (Remov. & Fixed)	6.6		X	
Durability	6.18			X
Temperature Life	6.19			X
Fluid Immersion - Lube Oil	6.20.1	X		
Fluid Immersion - Hydr. Oil	6.20.2		X	
Operating Torques	6.3	X	X	X
Insert Retention	6.21	X		
Dielectric Withstanding Voltage	6.5			X
Contact Retention	6.6			X
Insulation Resistance	6.4			X
Dielectric Withstanding Voltage (Alt.)	6.12			X
Contact Resistance	6.16			X
Final Examination of Product	6.22	X	X	X

6.0 Test Descriptions

Following are the descriptions of how each individual test will be performed.

6.1 Examination of Product

The individual connectors will be inspected for conformance to the applicable Bendix assembly drawings and for general quality of workmanship.

6.2 Wire and Prepare

Each connector half shall be permanently marked (etched) with its own test number, (ref. Para. 4.0). Each removable socket termination shall be crimped to a three foot length of teflon insulated wire and installed into the insert cavities. The Stub "E" connectors shall all be wired with nominal diameter 20 gage wire. Samples 1, 3 & 5 (81511) shall be wired with minimum diameter wire while 2,4 & 6 shall be wired with maximum diameter wire.

6.3 Operating Torques

Each plug shall be coupled to its counterpart receptacle and uncoupled at a slow uniform rate. The peak torques shall be measured using a torque wrench and appropriate fixturing. The torques shall be within the following limits:

	Torque - Lb. In.	
Connector	Max. Eng. & Disengaging	Minimum Disengaging
MIL-C-81511	28	4
Stub "E"	25	-

6.4 Insulation Resistance

The insulation resistance of the mated connectors shall be measured between each of 12 contacts and all other contacts and shell tied electrically in common. Six of the contacts shall be adjacent to the shell. The measurements shall be made at a test potential of 500 VDC ± 10% and electrification time shall not exceed 2 minutes. All values shall be greater than 5,000 megohms.

6.5 Dielectric Withstanding Voltage

The mated connectors shall have an AC potential applied between each contact and all other contacts and shell tied electrically in common for a period of 2 seconds per circuit. Leakage current shall not exceed 1 ma. The applied voltage shall be as follows:

Connector	Potential-A.C. RMS
81511	1300
Stub "E"	1500

6.6 Contact Retention

6.6.1 Removable Contacts

Fifteen contacts shall be removed and replaced with a specially made test contact for contact retention. This contact shall incorporate its own retention member release sleeve and have a "tail" long enough to allow a load to be applied. With this fixture in each contact cavity to be tested, a load will be applied at a rate of approximately 1 lb/sec. and monitored for a period of 5-10 seconds without being displaced by more than 0.012 in. while under load. The loads to be applied are:

Connector	Load-Lbs.
81511	10
Stub "E"	15

6.6.2 Fixed Contacts

Fifteen fixed contacts in each connector half shall have a load (see 6.6.1) applied to their mating ends at a rate of approximately 1 lb/sec. and monitored for a period of 5 to 10 seconds without being displaced by more than 0.012 in. while under load.

6.7 Maintenance Age

Each removable contact shall be removed from and reinserted into its individual insert cavity using appropriate insertion and removal tools. The fifteen contacts already subjected to contact retention shall be removed and reinserted an additional 9 times. The forces to insert and remove these contacts shall be measured on the 1st and 9th cycles.

6.8 Thermal Shock

The unmated connectors shall be subjected to 5 continuous cycles of temperature shock. Each cycle shall consist of 1/2 hour at $-65\ ^{+0°}_{-5°}$ C followed by 1/2 hour at $+175\ ^{+3°}_{-0°}$ C with no more than 5 minutes elapsing between temperature extremes. There shall be no damage detrimental to the operation of the connector after being subjected to this conditioning.

6.9 Vibration

The mated connectors shall be rigidly mounted on a vibration exciter using a suitable vibration test fixture and their normal mounting means. A minimum of 8 inches of wire shall be unsupported on both ends of the connector. The connector shall be subjected to a vibration level of either 0.06 inch d.a. or 20G peak, whichever is less. The vibration frequency shall be varied logarithmically between 10 and 2000 Hz and back to 10 Hz in a period of 20 minutes. The vibration sweep shall be applied 12 times (4 hours) in each of 3 mutually perpendicular axes. Each 4 hour period shall be conducted 1 hour at -65°C, 2 hours at room temperature and 1 hour at 175°C. During the vibration, the series wired contacts shall be monitored for discontinuities at a direct current of 100 ma. Discontinuities of 1 microsecond or greater will constitute a failure.

6.10 Shock

The mated connectors shall be rigidly mounted on a shock test machine using a suitable test fixture and their normal mounting means. A minimum of 8 inches of wire shall be unsupported on both ends of the connectors. The connectors shall be subjected to one shock pulse in each direction of each of the three mutually perpendicular axes. Each pulse shall be of approximately half-sine waveform, 50G peak and 11 milliseconds duration. The series wired contacts shall be monitored for discontinuities at a direct current of 100 ma. Discontinuities of 1 microsecond or greater shall constitute failure.

6.11 Moisture Resistance (81511 Only)

The mated 81511 type connectors shall be subjected to the moisture resistance test of MIL-STD-202, Method 106, with step 7b vibration excluded. After a minimum of 3 hours after completion of the final cycle, while the connectors are still subjected to high humidity, the insulation resistance shall be measured as specified in 6.4 except that it shall be 500 megohms or greater.

6.12 Dielectric Withstanding Voltage at Altitude (81511 only)

The mated 81511 type connectors shall be tested as specified in 6.5 except that they shall be placed in a vacuum chamber and evacuated to a simulated altitude of 110,000 feet for 1/2 hour and then subjected to a test potential of 1000V AC RMS.

6.13 Insulation Resistance at Elevated Temperature

The insulation resistance of the mated connectors shall be measured as in 6.4 except that they shall have been subjected to a temperature of 175°C for 30 minutes prior to making the measurements. All measurements shall be in excess of 200 megohms.

6.14 Air Leakage

The unmated plugs and receptacles shall be mounted on a test fixture suitable for application of a pressure of 30 psig to the mating face. The assembly shall be soaked at a temperature of -65°C and then pressurized to 30 psig. The leakage rate shall not be more than 1 in ^{3}/hour.

6.15 Water Immersion (81511 only)

The mated 81511 type connectors shall be immersed in tap water to a depth of 6 ft. for a period of 48 hours. They shall then be removed from the water and insulation resistance will be measured as specified in 6.4 except that all measurements shall be in excess of 100 megohms.

6.16 Contact Resistance

The resistance of 25 contact sets of each mated connector shall be measured. The four wire method of MIL-C-23216C (Figure 4) shall be used. The voltage drop across a 6 in. length (contact set approximately in the middle) shall be measured at the following test currents:

Connector Type	Contact Size	Wire Size	Test Curr. Amps. DC	Maximum Potential Drop M.V. Initial	After Temperature Life & Salt Spray
81511	22D	24	3	55	65
81511	22D	28	1 1/2	35	45
Stub"E"	20	20	7 1/2	60	70

6.17 Salt Spray (81511 only)

The unmated 81511 type connectors shall be subjected to the salt spray test as specified in MIL-STD-202, Method 101, Test Condition B. The salt concentration shall be 5%. Following the exposure the connectors shall be washed off with tap water and dried in a circulating air oven at a temperature of 38° ± 3°C for 12 hours maximum, after which they shall be removed and inspected. The connectors shall be mated and unmated one cycle to insure mateability and to remove free salt deposits.

6.18 Durability

The mating 81511 type connectors shall be subjected to 500 cycles of mating and unmating at a maximum rate of 300 cycles per hour. The Stub "E" connectors will be similarly subjected to 200 cycles. The coupling mechanism will be operated in a manner to simulate actual service operation. The connectors shall show no mechanical or electrical defects detrimental to the operation of the connector.

6.19 Temperature Life

The mated connectors shall be subjected to a temperature of 175°C for a period of 1000 hours. At the end of 1000 hours, while at 175°C, the insulation resistance shall be measured as specified in 6.4 except that all measurements shall be in excess of 200 megohms.

6.20 Fluid Immersion

6.20.1 Hydraulic Oil MIL-H-5606

The unmated connectors shall be immersed in the hydraulic oil at room temperature for 20 hours. The parts shall be allowed to drain for 1 hour at room temperature prior to being subjected to the subsequent tests.

6.20.2 Lubricating Oil MIL-L-23699

The unmated connectors shall be tested as in 6.20.1 except that MIL-L-23699 lube oil shall be used.

6.21 Insert Retention (81511 only)

The inserts in the 81511 type connector shells shall have axial loads applied to their mating faces at a rate of approximately 10 lb/sec until a load equivalent to 75 psig is reached. This load shall be retained for a period of 10 to 15 seconds without becoming dislodged.

6.22 Final Examination of Product

At the completion of testing, the connectors shall be examined for general condition and damage considered to be abnormal for the tests to which the connectors have been exposed.

7.0 Test Report

A test report shall be written at the completion of testing which is to include all pertinent test information, copies of original test data and conclusions. The report shall be written in standard Bendix/ECD Engineering Laboratory Report format. Three copies of this report will be supplied to USAECOM, Fort Monmouth, New Jersey.

8.0 Equipment List

The following equipment or suitable equivalent will be used in performing the foregoing tests:

Torque Fixture	Sturtevant	ICF-100-I
Torque Wrench	Sturtevant	M-5-1S
Torque Wrench	Sturtevant	M-25-1S
Torque Wrench	Sturtevant	M-50-1S
Megohm Bridge	General Radio	1644A
Automatic Connector Tester	Bendix	F-1680
High Voltage A.C. Supply	Bendix	L-9947-25
Universal Testing Machine	Instron	TTC
Thermal Shock Machine	Blue-M	WSP109C-3
Vibration Test System	M-B	C-20
Shock Test Machine	Consol. Vac.	3" Hyge
Humidity Chamber	Blue-M	FR-386
Circulating Air Oven	Blue-M	POM-206C
Cold Chamber	Murphy & Miller	LTF-4-120
Constant Current Power Supply	Kepco	KS-18-10M
Digital Voltmeter	Hewlett Packard	3450A
Ammeter	Weston	931
Salt Spray Chamber	Ind. Filter & Pump Co.	411-1C
Connector Durability Machine	Bendix	44-76531

Lewis A. Armitage
Engineering Laboratory

ds

APPENDICIES B

DATA SHEETS

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
OPERATING TORQUES	6-21-72	12-5193

TEST SPECIMEN (S)	LT.	TEMP	R.H.	ECL
L-27758-24 PLUGS MATED WITH L-27758-25 RECEPTACLES	3128	74°	36%	0540-A-4

SPEC.	PARA.
L-18081-98	6.3

TEST EQUIPMENT	CAL. DATE	DUE DATE
STURTEVANT TORQUE WRENCH	5-24-72	8-7-72

SPEC. LIMITS MAX-28 lb-INCHES MIN-4 lb-INCHES

TEST CONDITIONS ROOM AMBIENT INITIAL

MATED CONNECTOR PAIR #1		
	MATING FORCE	UNMATING FORCE
	12½ lb-inches	15½ lb-inches
MATED CONNECTOR PAIR #2		
	MATING FORCE	UNMATING FORCE
	7¾ lb-inches	10 lb-inches
MATED CONNECTOR PAIR #3		
	MATING FORCE	UNMATING FORCE
	10¾ lb-inches	15 lb-inches
MATED CONNECTOR PAIR #4		
	MATING FORCE	UNMATING FORCE
	11½ lb-inches	12 lb-inches
MATED CONNECTOR PAIR #5		
	MATING FORCE	UNMATING FORCE
	10 lb-inches	15 lb-inches
MATED CONNECTOR PAIR #6		
	MATING FORCE	UNMATING FORCE
	10 lb-inches	11½ lb-inches

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.R. NAPOLITANO

APPROVED BY [illegible]

WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST			DATE OF TESTS	REPORT NUMBER
INSULATION RESISTANCE			6-23-72	12-5193
TEST SPECIMEN (S) L-27758-24 PLUGS MATED			TEMP. 74° R.H. 38%	ECL 0540A-5
WITH L-27758-25 RECEPTACLES #1		LT. 3128	SPEC. L-15081-98	PARA. 6.4
TEST EQUIPMENT F-1514	CAL. DATE	DUE DATE	SPEC. LIMITS	
GENERAL RADIO MEGOHM BRIDGE 1644A	9-1-71	8-29-72	5,000 MEGOHMS	
SWITCHING FIXTURE BOX 8 E-4306	PRIOR TO USE		TEST CONDITIONS ROOM AMBIENT INITIAL	
			Test Potential 500 volts DC	

CONTACT	INSULATION RESISTANCE	
1	3.2×10^6	MEGOHMS
4	1×10^6	"
8	1.1×10^6	"
18	1.7×10^6	"
22	2×10^6	"
29	2×10^6	"
35	1.2×10^6	"
41	1.8×10^6	"
48	2.4×10^6	"
57	2.2×10^6	"
60	1.4×10^6	"
72	2×10^6	"
75	1.5×10^6	"
82	2.2×10^6	"
85	4×10^6	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY W.E. DENNY

APPROVED BY [signature]

WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST: Insulation Resistance		DATE OF TESTS: 6-23-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-24 Plug mated with L-27758-25 Receptacle #2	LT. 3128	TEMP. 74° / R.H. 38%	ECL 0540A-6
		SPEC. L-15081-98	PARA. 6.4
TEST EQUIPMENT: 1644A F-1514 General Radio Megohms Bridge	CAL. DATE 9-1-71 / DUE DATE 8-29-72	SPEC. LIMITS: 5,000 Megohms	
Switching Fixture Box & F-4306	Prior To Use	TEST CONDITIONS: Room Ambient, Initial, Test Potential 500 volts DC	

Contact	Insulation Resistance	
1	2×10^4	Megohms
4	3×10^6	"
8	4×10^6	"
18	2.4×10^6	"
22	4.5×10^6	"
29	3×10^6	"
35	5×10^4	"
41	30×10^6	"
48	2.5×10^6	"
57	1.4×10^6	"
60	25×10^4	"
72	20×10^6	"
78	4×10^6	"
82	2×10^6	"
85	3.5×10^6	"

REF.

Bendix Electrical Components Division, Sidney, New York 13838

TESTED BY: T. A. Napolitano

APPROVED BY: [illegible]

WITNESSED BY:

72-354-2

3

LABORATORY DATA SHEET

TEST: INSULATION RESISTANCE		DATE OF TESTS: 6-23-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-24 PLUG MATED		TEMP: 74°F R.H.: 38%	ECL: 0540A-7
WITH L-27758-25 RECEPTACLES #3	LT. 3128	SPEC. L-15081-98	PARA. 6.4
TEST EQUIPMENT		SPEC. LIMITS: 5,000 megohms	

TEST EQUIPMENT	CAL. DATE	DUE DATE
F-1514 General Radio Megohm Bridge 1644A	9-1-72	8-29-72
Switching Fixture Box 8 E-4306	Prior To	Use

TEST CONDITIONS: Room Ambient

Initial

Test Potential 500volts DC

Contact	Insulation Resistance	
1	3.2×10^6	megohms
4	2.2×10^6	"
8	2×10^6	"
18	6×10^6	"
22	3.5×10^6	"
29	2.5×10^6	"
35	12×10^6	"
41	15×10^6	"
48	12×10^6	"
57	2.5×10^6	"
60	12×10^6	"
72	12.6×10^6	"
78	13.6×10^6	"
82	4×10^6	"
85	15×10^6	"

REF.

Bendix Electrical Components Division

Sidney, New York 13838

TESTED BY: T.A. Napolitano

APPROVED BY: [illegible]

WITNESSED BY

72-354-2

4

LABORATORY DATA SHEET

TEST: INSULATION RESISTANCE		DATE OF TESTS: 6-23-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-24 PLUG MATED WITH L-27758-25 RECEPTACLE #4	LT. 3128	TEMP. 74°F R.H. 38%	ECL 05409-8
		SPEC. L15081.98	PARA. 6.4
TEST EQUIPMENT: F.1614 GENERAL RADIO MEGOHM BRIDGE 1644A; SWITCHING FIXTURE BOX 8 E.4386	CAL. DATE: 9-1-71 / PRIOR TO / DUE DATE: 8-29-72 / USE	SPEC. LIMITS: 5000megohms	
		TEST CONDITIONS: ROOM AMBIENT INITIAL. Test Potential 500 volts DC	

CONTACT	INSULATION RESISTANCE	
1	7.5×10^6	MEGOHMS
4	20×10^6	"
8	12×10^6	"
18	15×10^6	"
22	15×10^6	"
29	8×10^6	"
35	20×10^6	"
*41		
48	7×10^6	"
57	10×10^6	"
60	15×10^6	"
72	6×10^6	"
78	5×10^6	"
82	17×10^6	"
85	20×10^6	"
46	20×10^6	"

* This contact failed Dielectric withstanding voltage, apparently due to carbon trace. another contact was choosen.

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. NAPOLITANO
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

5

LABORATORY DATA SHEET

TEST	INSULATION RESISTANCE
TEST SPECIMEN (S)	L-27758-24 PLUG MATED WITH L-27758-25 RECEPTACLE #5
LT.	312F
TEST EQUIPMENT	GENERAL RADIO MEGOHM BRIDGE 1644A F-1514; SWITCHING FIXTURE BOX 8 E-4306
CAL. DATE	9-1-71; PRIOR TO USE
DUE DATE	8-29-72
DATE OF TESTS	6-23-72
REPORT NUMBER	12-5193
TEMP.	74°
R.H.	38%
ECL	0540A-9
SPEC.	L-15081-98
PARA.	6.4
SPEC. LIMITS	5,000 MEGOHMS
TEST CONDITIONS	ROOM AMBIENT; INITIAL; Test Potential 500 volts DC

CONTACT	INSULATION	RESISTANCE
1	32×10^6	MEGOHMS
4	10×10^6	"
8	8×10^6	"
18	7×10^6	"
22	12×10^6	"
29	1.8×10^6	"
35	28×10^6	"
41	20×10^6	"
48	25×10^6	"
57	2.8×10^6	"
60	27×10^6	"
72	30×10^6	"
78	3.5×10^6	"
82	23×10^6	"
85	20×10^6	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.A. NAPOLITANO
APPROVED BY [illegible]
WITNESSED BY

72-354-2

6

LABORATORY DATA SHEET

TEST: Insulation Resistance		DATE OF TESTS: 2-23-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-24 Plug mated with L-27758-25 Receptacle #6	LT. 0128	TEMP. 74°F R.H. 38%	ECL 0540A-10
		SPEC. L-15081-98	PARA. 6.4
TEST EQUIPMENT: General Radio Megohm Bridge F-1514	CAL. DATE 9-1-71	DUE DATE 8-29-72	SPEC. LIMITS 5,000 megohms
Switching Fixture Box E-4306	Prior to	Use	TEST CONDITIONS Room Ambient, Initial
			Test Potential 500 Volts DC

Contact	Insulation Resistance	
1	14 x 10^6	Megohms
4	10.2 x 10^6	"
8	15 x 10^6	"
18	4 x 10^6	"
22	12 x 10^6	"
29	15 x 10^6	"
35	19 x 10^6	"
41	20 x 10^6	"
48	6 x 10^6	"
57	25 x 10^6	"
60	25 x 10^6	"
72	30 x 10^6	"
78	10 x 10^6	"
82	30 x 10^6	"
85	6 x 10^6	"

REF.

Bendix Electrical Components Division

TESTED BY: T. A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

7

LABORATORY DATA SHEET

TEST: DIELECTRIC WITHSTANDING VOLTAGE		DATE OF TESTS: 6-23-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-24 Plugs mated with L-27758-25 Receptacles	LT. 3128	TEMP. 74°F R.H. 38%	ECL 0540A-11
		SPEC. L-15081-98	PARA. 6.5
TEST EQUIPMENT: Automatic Connector Tester F-1680	CAL. DATE 6-1-72 / DUE DATE 6-29-72	SPEC. LIMITS 1300 VAC-RMS	
		TEST CONDITIONS Room Ambient Initial	

Plug 58-24/1 mated with 58-25/1 Receptacle		
Circuit	Failing Voltage	Failure occurred in
47	750	Recept.
48	750	"
68	750	Plug
Plug 58-24/2 mated with 58-25/2 Receptacle		
Circuit	Failing voltage	Failure occurred in
44	750	Recept.
45	900	"
Plug 58-24/3 mated with 58-25/3 Receptacle		
Circuit	Failing Voltage	Failure occurred in
54	650	Recept.
55	1150	"
36	1150	"
45	750	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.A. Napolitano
APPROVED BY [signature]
WITNESSED BY

8

72-354-2

LABORATORY DATA SHEET

TEST: DIELECTRIC WITHSTANDING VOLTAGE		DATE OF TESTS: 6·23·72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L·27758-24 PLUGS MATED WITH L·27758·25 RECEPTACLES	LT. 8128	TEMP. 74°F / R.H. 38% / ECL 0540·A-12	
		SPEC. L-13081-98	PARA. 6.5

TEST EQUIPMENT	CAL. DATE	DUE DATE	
Automatic Connector Tester E4680	6-1-72	6-29-72	SPEC. LIMITS: 1300 VAC RMS
			TEST CONDITIONS: Room Ambient Initial

PLUG 58-24/4 mated with 58-25/4 Receptacle

Circuit	Failing Voltage	Failure occurred in
5	500	RECEPT.
35	650	"
65	500	"
21	650	PLUG
22	850	"
23	400	"
31	650	"
32	<250	"
33	400	"
41	<250	"
42	1000	"
43	400	"
52	400	"

PLUG 58-24/5 mated with 58-25/5 Receptacle
ALL CIRCUITS PASSED DIELECTRIC WITHSTANDING VOLTAGE

PLUG 58-24/6 mated with 58·25/6 Receptacle

Circuit	Failing Voltage	Failure occurred in
55	1150	RECEPT.
64	400	"
65	1150	"
72	600	"
41	750	PLUG
51	800	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. NAPOLITANO
APPROVED BY: [signature]
WITNESSED BY

72-354-2

9

LABORATORY DATA SHEET

TEST: CONTACT INSERTION AND REMOVAL FORCES	DATE OF TESTS: 6-21-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-25 RECEPTACLE #1	TEMP 74°F R.H. 36%	ECL 054D-A-13
LT. 3128	SPEC. L-15081-95	PARA. 6.7

TEST EQUIPMENT	CAL. DATE	DUE DATE
"D" LOAD CELL	PRIOR TO	USE
DAYTRONIC STRAIN GAGE 601C (#-4011)	PRIOR TO	USE
HONEYWELL ELECTRONIK 19 (F-1366)	6-15-72	9-15-72

SPEC. LIMITS:

TEST CONDITIONS: INITIAL

CONTACT	1ST INSERTION	1ST REMOVAL	9TH INSERTION	9TH REMOVAL
1	6 3/4 lbs	2 lbs	4 lbs	1 1/2 lbs
4	6 1/4 lbs	1 3/4 lbs	4 lbs	1 3/4 lbs
8	7 1/4 lbs	1 3/4 lbs	4 1/4 lbs	1 1/2 lbs
18	6 1/4 lbs	2 1/4 lbs	4 3/4 lbs	1 3/4 lbs
22	7 3/4 lbs	2 1/2 lbs	5 lbs	1 1/4 lbs
29	7 1/4 lbs	3 lbs	5 lbs	1 1/4 lbs
35	8 lbs	2 lbs	4 1/4 lbs	2 lbs
41	6 1/2 lbs	1 3/4 lbs	4 1/4 lbs	1 1/4 lbs
48	7 lbs	3 lbs	5 lbs	2 lbs
57	8 lbs	3 1/4 lbs	4 3/4 lbs	1 3/4 lbs
60	6 3/4 lbs	3 1/4 lbs	4 lbs	1 1/4 lbs
72	8 1/4 lbs	2 lbs	3 1/4 lbs	1 1/2 lbs
78	8 lbs	1 1/2 lbs	3 1/4 lbs	1 1/4 lbs
82	7 3/4 lbs	2 3/4 lbs	3 1/4 lbs	2 lbs
85	7 1/4 lbs	2 1/4 lbs	3 1/4 lbs	1 3/4 lbs

REF.

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY: T.A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

10

LABORATORY DATA SHEET

TEST: CONTACT INSERTION AND REMOVAL FORCES	DATE OF TESTS: 6-21-72	REPORT NUMBER: 12-5193		
TEST SPECIMEN (S): L-27758-25 RECEPTACLE #2	TEMP: 74°F	R.H.: 36%	ECL: 0340-A-14	
LT.: 3128	SPEC.: L-15081-98	PARA.: 6.7		

TEST EQUIPMENT	CAL. DATE	DUE DATE
"D" LOAD CELL	PRIOR TO	USE
DAYTRONIC STRAIN GAGE 6010 E-4011	PRIOR TO	USE
HONEYWELL ELECTRONIK 19 F-1366	6-16-72	9-12-72

SPEC. LIMITS:

TEST CONDITIONS: INITIAL

	1ST		9TH	
CONTACT	INSERTION	REMOVAL	INSERTION	REMOVAL
1	8 lbs	4 lbs	~~3 lbs~~ 3 3/4 lbs	1 3/4 lbs
4	7 1/4 lbs	2 lbs	4 1/2 lbs	2 lbs
8	8 lbs	2 1/4 lbs	4 3/4 lbs	2 lbs
18	7 lbs	2 1/2 lbs	4 3/4 lbs	2 lbs
22	7 3/4 lbs	2 3/4 lbs	5 lbs	2 3/4 lbs
29	8 3/4 lbs	2 1/4 lbs	6 1/2 lbs	2 lbs
35	7 lbs	2 1/2 lbs	6 1/2 lbs	2 lbs
41	7 3/4 lbs	2 lbs	4 1/2 lbs	2 lbs
48	9 lbs	2 1/2 lbs	4 3/4 lbs	2 1/2 lbs
57	9 lbs	3 lbs	6 1/2 lbs	3 lbs
60	8 lbs	2 1/4 lbs	6 lbs	2 lbs
72	9 lbs	2 3/4 lbs	6 3/4 lbs	3 lbs
78	9 1/4 lbs	2 1/4 lbs	7 lbs	2 1/4 lbs
82	7 lbs	2 lbs	6 1/2 lbs	2 1/4 lbs
85	7 1/4 lbs	2 1/4 lbs	6 lbs	2 lbs

REF.

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY: T. A. NAPOLITANO

APPROVED BY: [illegible]

WITNESSED BY:

72-354-2

11

LABORATORY DATA SHEET

TEST: CONTACT INSERTION AND REMOVAL FORCES		DATE OF TESTS: 6-21-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27755-24 PLUG #1		TEMP: 74°F R.H.: 36%	ECL: 05404-15
	LT.: 3128	SPEC.: L-15081-98	PARA.: 6.7

TEST EQUIPMENT	CAL. DATE	DUE DATE
"D" LOAD CELL	PRIOR TO	USE
DAYTRONIC STRAINGAGE 6010 E-4011	PRIOR TO	USE
HONEYWELL ELECTRONIK 19 E-1366	6-16-72	9-12-72

SPEC. LIMITS:

TEST CONDITIONS: INITIAL

CONTACT	1ST INSERTION	REMOVAL	9TH INSERTION	REMOVAL
1	7 1/2 lbs	2 lbs	3 lbs	2 lbs
4	6 lbs	1 1/4 lbs	3 1/2 lbs	2 lbs
8	7 1/4 lbs	2 lbs	4 1/4 lbs	1 1/2 lbs
18	6 1/2 lbs	1 1/2 lbs	3 3/4 lbs	1 1/4 lbs
22	6 1/4 lbs	2 lbs	3 1/4 lbs	1 3/4 lbs
29	7 1/4 lbs	1 3/4 lbs	2 1/2 lbs	1 1/2 lbs
35	5 1/4 lbs	2 lbs	4 lbs	1 1/2 lbs
41	3 3/4 lbs	1 1/2 lbs	3 lbs	1 lb
48	7 1/2 lbs	2 3/4 lbs	3 lbs	1 1/2 lbs
57	6 1/4 lbs	3 1/4 lbs	3 1/2 lbs	1 1/2 lbs
60	4 1/2 lbs	1 3/4 lbs	3 1/4 lbs	1 3/4 lbs
72	5 1/4 lbs	3 lbs	3 1/2 lbs	1 1/2 lbs
78	6 lbs	1 1/2 lbs	3 3/4 lbs	1 1/2 lbs
82	6 lbs	2 1/2 lbs	4 lbs	2 lbs
85	6 lbs	3 1/4 lbs	5 lbs	1 3/4 lbs

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. NAPOLITANO
APPROVED BY: A.G.W.
WITNESSED BY

72-354-2

12

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
CONTACT INSERTION AND REMOVAL FORCES	6-21-72	12-5193
TEST SPECIMEN (S) L-27758-24 PLUG # 2	TEMP 74°F R.H 36%	ECL 0540A-16
LT. 3128	SPEC. L-15081-98	PARA. 6.7

TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS
"D" LOAD CELL	PRIOR TO	USE	
DAYTRONIC STRAIN GAGE 601A E-4011	PRIOR TO	USE	TEST CONDITIONS: INITIAL
HONEYWELL ELECTRONIK 19 F-1366	6-16-72	9-12-72	

	1ST		9TH	
CONTACT	INSERTION	REMOVAL	INSERTION	REMOVAL
1	6 1/2 lbs	1 3/4 lbs	3 1/4 lbs	1 3/4 lbs
4	8 1/4 lbs	2 lbs	5 1/4 lbs	2 1/4 lbs
8	6 3/4 lbs	2 1/4 lbs	5 1/4 lbs	2 lbs
18	8 3/4 lbs	2 3/4 lbs	4 1/2 lbs	1 3/4 lbs
22	7 1/2 lbs	2 1/4 lbs	5 3/4 lbs	2 1/4 lbs
29	6 lbs	2 1/4 lbs	4 lbs	2 1/4 lbs
35	9 lbs	2 1/2	5 1/4 lbs	1 3/4 lbs
41	6 3/4 lbs	2 lbs	6 lbs	2 lbs
48	7 lbs	2 1/4 lbs	4 1/4 lbs	2 lbs
57	8 1/2 lbs	2 lbs	5 1/2 lbs	2 lbs
60	8 1/4 lbs	2 1/4 lbs	3 1/2 lbs	2 lbs
72	7 1/4 lbs	2 3/4 lbs	3 1/2 lbs	1 1/2 lbs
78	9 3/4 lbs	2 1/4 lbs	4 1/4 lbs	1 3/4 lbs
82	8 lbs	3 1/4 lbs	4 3/4 lbs	1 3/4 lbs
85	4 1/4 lbs	2 lbs	5 lbs	2 lbs

REF.

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY T. A. NAPOLITANO
APPROVED BY [illegible signature]
WITNESSED BY

72-354-2

13

LABORATORY DATA SHEET

TEST		DATE OF TESTS	REPORT NUMBER
Contact Retention (Removable Contacts)		6-28-72	12-5193
TEST SPECIMEN (S): 1. 77758-24 Plugs #1		TEMP. 74° / R.H. 47%	ECL 0540A-17
1. 77758-25 Receptacle #1	LT. 3129	SPEC. 1-15081-98	PARA. 6.6.1
TEST EQUIPMENT	CAL. DATE / DUE DATE	SPEC. LIMITS	
Instron PG 1050	2-25-72 / 8-25-72	10 lbs .012" displacement	
		TEST CONDITIONS: Initial	
		Rate 1 lb/second	

Plug #1				Receptacle #1		
Contact	Load	Displacement		Contact	Load	Displacement
1	10 lbs	.004		1	10 lbs	.002
4	"	.004		4	"	.002
8	"	.0045		8	"	.003
18	"	.0045		18	"	.002
22	"	.003		22	"	.002
29	"	.0035		29	"	.004
35	"	.002		35	"	Pulled out at 7 lbs
41	"	.0035		41	"	.0035
48	"	.004		48	"	.003
57	"	.004		57	"	.0035
60	"	.0045		60	"	.0035
72	"	.0035		72	"	.003
78	"	.004		78	"	.004
82	"	.0035		82	"	.0045
85	"	.0035		85	"	.0035

REF. All displacements in inch

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. Napalitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

LABORATORY DATA SHEET

TEST	CONTACT RETENTION (REMOVABLE CONTACTS)
DATE OF TESTS	6-28-72
REPORT NUMBER	12-5193
TEMP.	74°F
R.H.	40%
ECL	0540A-18
TEST SPECIMEN (S)	L-27758-24 PLUG #2; L-27758-25 RECEPTACLE #2
LT.	3128
SPEC.	L-18081-98
PARA.	6.6.1
TEST EQUIPMENT	INSTRON PG 1050
CAL. DATE	2-25-72
DUE DATE	8-25-72
SPEC. LIMITS	10 Lbs .012" displacement
TEST CONDITIONS	INITIAL; RATE 1 lb/second

PLUG #2			RECEPTACLE #2		
CONTACT	LOAD	DISPLACEMENT	CONTACT	LOAD	DISPLACEMENT
1	10 Lbs	.003"	1	10 Lbs	.004"
4	"	.005"	4	"	.0035"
8	"	.005"	8	"	.004"
18	"	.0045"	18	"	.003"
22	"	.004"	22	"	.005"
29	"	.0045"	29	"	.004"
35	"	.0045"	35	"	.003"
41	"	.0025"	41	"	.0035"
48	"	.003"	48	"	.003"
57	"	.003"	57	"	.006"
60	"	.003"	60	"	.004"
72	"	.0025"	72	"	.007"
78	"	.0035"	78	"	.0035"
82	"	.003"	82	"	.0025"
95	"	.0035"	85	"	.003"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.A. NABLTAND
APPROVED BY [signature]
WITNESSED BY

15

72-354-2

LABORATORY DATA SHEET

TEST	CONTACT RETENTION (REMOVABLE CONTACTS)
DATE OF TESTS	6-28-72
REPORT NUMBER	12.5193
TEMP	74°F
R.H.	40%
ECL	0540A-19
TEST SPECIMEN (S)	L-27758-24 PLUG #3 L-27758-25 RECEPTACLE #3
LT.	3128
SPEC.	L-15081-98
PARA.	6.6.1
TEST EQUIPMENT	INSTRON PC 1050
CAL. DATE	2-25-72
DUE DATE	8-25-72
SPEC. LIMITS	10 Lbs .012" displacement
TEST CONDITIONS	INITIAL RATE 1 Lb/second

PLUG #3				RECEPTACLE #3			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	10 Lbs	.0025	inch	1	10 Lbs	.0035	inch
4	"	.0035	"	4	"	.003	"
8	"	.0035	"	8	"	.004	"
18	"	.0045	"	18	"	.0035	"
22	"	.004	"	22	"	.0045	"
29	"	.0045	"	29	"	.004	"
35	"	.004	"	35	"	.0035	"
41	"	.004	"	41	"	.003	"
48	"	.004	"	48	"	.004	"
57	"	.0035	"	57	"	.0025	"
60	"	.004	"	60	"	.0035	"
72	"	.0035	"	72	"	.004	"
78	"	.003	"	78	"	.004	"
82	"	.0065	"	82	"	.004	"
85	"	.004	"	85	"	.004	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.A. NAPOLITANO
APPROVED BY [illegible]
WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST: Contact Retention (Removable Contacts)	DATE OF TESTS: 6-28-72	REPORT NUMBER: 12-5193	
TEST SPECIMEN (S): L-27758-24 Plug # 4; L-27758-25 Receptacle # 4	LT. 3128	TEMP. 74°F	R.H. 40%	ECL #0540A-20
		SPEC. L-15081-98	PARA. 6.6.1
TEST EQUIPMENT: Instron PG 1050	CAL. DATE 2-25-72	DUE DATE 8-25-72	SPEC. LIMITS 10 Lbs .012" displacement
			TEST CONDITIONS: Initial; Rate 1/6/second

Plug # 4				Receptacle # 4		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	10 Lbs	.0035	inch	1	10 Lbs	.003 inch	
4	"	.005	"	4	"	.004	"
8	"	.004	"	8	"	.003	"
18	"	.0025	"	18	"	.002	"
22	"	.003	"	22	"	.003	"
29	"	.003	"	29	"	.003	"
35	"	.0025	"	35	"	.004	"
41	"	.003	"	41	"	.003	"
48	"	.0035	"	48	"	.0025	"
57	"	.003	"	57	"	.0065	"
60	"	.003	"	60	"	.003	"
72	"	.0025	"	72	"	.002	"
78	"	.003	"	78	"	.003	"
82	"	.0025	"	82	"	.003	"
85	"	.004	"	85	"	.004	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. Napolitano
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

LABORATORY DATA SHEET

TEST: Contact Retention (Removable Contacts)		DATE OF TESTS: 6-28-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): 1-27258-24 Plug #5		TEMP: 75°F R.H.: 40%	EC: 0540A-21
1-27258-25 Receptacle #5	LT. 3128	SPEC. 1-15081-98	PARA. 6.6.1
TEST EQUIPMENT: Instron PC1050	CAL. DATE: 2-25-72 / DUE DATE: 8-25-72	SPEC. LIMITS: 10 lbs .012" displacement	
		TEST CONDITIONS: Initial; Rate 1 in/sec ...	

	Plug #5				Receptacle #5		
Contact	Load	Displacement		Contact	Load	Displacement	
1	10 lbs	.005	inch	1	10 lbs	.0035	inch
4	"	.0045	"	4	"	.0035	"
8	"	.005	"	8	"	.003	"
18	"	.005	"	18	"	.003	"
22	"	.004	"	22	"	~~Pushed~~ Pulled out at 7 lbs	
29	"	.0055	"	29	"	.0035	inch
35	"	.004	"	35	"	.004	"
41	"	.0045	"	41	"	.0035	"
48	"	.0035	"	48	"	.003	"
57	"	.0035	"	57	"	.003	"
60	"	.004	"	60	"	.005	"
72	"	.003	"	72	"	.0035	"
78	"	.0035	"	78	"	.003	"
82	"	.0035	"	82	"	.0035	"
85	"	.004	"	85	"	.0025	"

REF

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

18

LABORATORY DATA SHEET

TEST: Contact Retention (Removable Contact)	DATE OF TESTS: 6-28-72	REPORT NUMBER: 12-5193		
TEST SPECIMEN (S): L-27758-24 Plug #6	TEMP: 75°F	R.H.: 40%	ECL: 0540 A-22	
L-27758-25 Receptacle #6	LT.: 3128	SPEC.: 1-15081-98	PARA.: 6.6.1	
TEST EQUIPMENT: Instron PO 1050	CAL. DATE: 2-25-72	DUE DATE: 8-25-72	SPEC. LIMITS: 10 lbs .012" displacement	
			TEST CONDITIONS: Initial Rate 1 lb/second	

Plug #6				Receptacle #6			
Contact	Load	Displacement		Contact	Load	Displacement	
1	10 lbs	.0035	inch	1	10 lbs	.003	inch
4	"	.0035	"	4	"	.002	"
8	"	.0035	"	8	"	.0035	"
18	"	.005	"	18	"	.004	"
22	"	.0035	"	22	"	.0025	"
29	"	.003	"	29	"	.004	"
35	"	.003	"	35	"	.003	"
41	"	.003	"	41	"	.003	"
48	"	.004	"	48	"	.004	"
57	"	.004	"	57	"	.0045	"
60	"	.0025	"	60	"	.003	"
72	"	.0035	"	72	"	.004	"
78	"	.004	"	78	"	.004	"
82	"	.003	"	82	"	.0035	"
85	"	.004	"	85	"	.004	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

19

LABORATORY DATA SHEET

TEST	Contact Retention (Fixed Contacts)
TEST SPECIMEN (S)	L-27758-24 Plug #1
	L-27758-25 Receptacle #1 — LT. 3128
TEST EQUIPMENT	Instron PC 1050 — CAL. DATE 2-25-72 — DUE DATE 8-25-72
DATE OF TESTS	6-29-72
REPORT NUMBER	12-5193
TEMP.	74°F
R.H.	48%
ECL	05404-23
SPEC.	L-15081-98
PARA.	6.6.2
SPEC. LIMITS	10 Lbs .012" displacement
TEST CONDITIONS	Initial Rate 1 in/second

Plug #1				Receptacle #1			
Contact	Load	Displacement		Contact	Load	Displacement	
1	10 Lbs	.002	inch	1	10 Lbs	.0035	inch
4	"	.003	"	4	"	.004	"
8	"	.003	"	8	"	.0025	"
18	"	.0025	"	18	"	.003	"
22	"	.002	"	22	"	.003	"
29	"	.003	"	29	"	.0035	"
35	"	.006	"	35	"	.002	"
41	"	.0025	"	41	"	.004	"
48	"	.0035	"	48	"	.0045	"
57	"	.003	"	57	"	.004	"
60	"	.0025	"	60	"	.005	"
72	"	.002	"	72	"	.004	"
78	"	.0025	"	78	"	.0045	"
82	"	.003	"	82	"	.002	"
85	"	.0025	"	85	"	.005	"

R.F.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.A. Napolitano
APPROVED BY [illegible]
WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST	Contact Retention (Fixed Contacts)
DATE OF TESTS	6-29-72
REPORT NUMBER	12-5193
TEMP	74 °F
R.H.	48%
ECL	0540A-24
TEST SPECIMEN (S)	L-27758-24 Plug #2; L-27758-25 Receptacle #2
LT.	3128
SPEC.	L-15081-98
PARA.	6.6.2
TEST EQUIPMENT	Instron PG 1050
CAL. DATE	2-25-72
DUE DATE	8-25-72
SPEC. LIMITS	10 Lbs .012" displacement
TEST CONDITIONS	Initial Rate 1 lb/second

Plug #2				Receptacle #2			
Contact	Load	Displacement		Contact	Load	Displacement	
1	10 Lbs	.003	inch	1	10 Lbs	.004	inch
4	"	.005	"	4	"	.0015	"
8	"	.002	"	8	"	.003	"
18	"	.0075	"	18	"	.005	"
22	"	.003	"	22	"	.005	"
29	"	.0065	"	29	"	.0035	"
35	"	.003	"	35	"	.001	"
41	"	.004	"	41	"	.002	"
48	"	.0065	"	48	"	.0025	"
57	"	.0035	"	57	"	.0025	"
60	"	.006	"	60	"	.002	"
72	"	.005	"	72	"	.002	"
78	"	.004	"	78	"	.004	"
82	"	.0045	"	82	"	.004	"
85	"	.007	"	85	"	.003	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.A. Napolitano
APPROVED BY RAG
WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST: CONTACT RETENTION (FIXED CONTACTS)		DATE OF TESTS: 6-29-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-22758-24 PLUG # 3		TEMP: 74°F / R H: 48%	ECL: 0540A-35
L-22758-25 Receptacle # 3	LT. 3128	SPEC. L-15081-98	PARA. 6.6.2
TEST EQUIPMENT: INSTRON PC 1050	CAL. DATE 2-25-72 / DUE DATE 8-25-72	SPEC. LIMITS: 10 Lbs .012" displacement	
		TEST CONDITIONS: INITIAL Rate 1 lb/second	

Plug #3				Receptacle #3			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	10 Lbs	.004	inch	1	10 Lbs	.0045	inch
4	"	.008	"	4	"	.004	"
8	"	.008	"	8	"	.002	"
18	"	.0055	"	18	"	.002	"
22	"	.0035	"	22	"	.002	"
29	"	.0035	"	29	"	.0035	"
35	"	.008	"	35	"	.002	"
41	"	.0025	"	41	"	.0015	"
48	"	.0025	"	48	"	.0045	"
57	"	.006	"	57	"	.003	"
60	"	.003	"	60	"	.0015	"
72	"	.0025	"	72	"	.004	"
78	"	.0035	"	78	"	.0045	"
82	"	.0035	"	82	"	.0025	"
85	"	.0055	"	85	"	.002	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: DAA
WITNESSED BY:

72-354-2

LABORATORY DATA SHEET

TEST: Contact Retention (Removable Contacts)	DATE OF TESTS: 7-5-72
	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-24 Plug #1	TEMP: 74° R.H.: 42% ECL: 0540A-26
L-27758-25 Receptacle #1 LT. 3128	SPEC.: L-15081-98 PARA.: 6.6.1
TEST EQUIPMENT: Instron PG 1050 CAL. DATE: 2-25-72 DUE DATE: 8-25-72	SPEC. LIMITS: 10 lbs .012" displacement
	TEST CONDITIONS: Maintenance Age Rate 1 lb/second

Plug #1				Receptacle #1			
Contact	Load	Displacement		Contact	Load	Displacement	
1	10 lbs	.004	inch	1	10 lbs	.003	inch
4	"	.0035	"	4	"	.004	"
8	"	.004	"	8	"	.003	"
18	"	.004	"	18	"	.005	"
22	"	.0035	"	22	"	.0045	"
29	"	.004	"	29	"	.006 ~~Pushed out at 7lbs~~	"
35	"	.004	"	35	"	Pulled ~~Pushed~~ out at 7lbs	
41	"	.004	"	41	"	.004	inch
48	"	.005	"	48	"	.003	"
57	"	.0045	"	57	"	.003	"
60	"	.003	"	60	"	.003	"
72	"	.004	"	72	"	.0035	"
78	"	.004	"	78	"	.002	"
82	"	.004	"	82	"	.0035	"
85	"	.005	"	85	"	.003	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

23

LABORATORY DATA SHEET

TEST: CONTACT RETENTION (REMOVABLE CONTACTS)			DATE OF TESTS: 7-5-72	REPORT NUMBER: 12-5193
TEST SPECIMEN (S): L-27758-24 PLUG #2			TEMP 74° R.H. 42%	ECL 0540A-27
L-27758-25 RECEPTACLE #2		LT. 3128	SPEC. L-15091-98	PARA. 6.6.1
TEST EQUIPMENT: INSTRON PG1050	CAL. DATE 2-25-72	DUE DATE 8-25-72	SPEC. LIMITS 10 Lbs .012" displacement	
			TEST CONDITIONS: MAINTENANCE AGE RATE 1 lb/second	

PLUG #2				RECEPTACLE #2			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	10 Lbs	.003	inch	1	"	.005	inch
4	"	.0035	"	4	"	.0045	"
8	"	.0035	"	8	"	.004	"
18	"	.0045	"	18	"	.0035	"
22	"	.0035	"	22	"	.0045	"
29	"	.006	"	29	"	.0045	"
35	"	.006	"	35	"	.003	"
41	"	.0035	"	41	"	.0045	"
48	"	.004	"	48	"	.0045	"
57	"	.0045	"	57	"	.005	"
60	"	.0035	"	60	"	.003	"
72	"	.0035	"	72	"	.003	"
78	"	.004	"	78	"	.003	"
82	"	.004	"	82	"	.003	"
85	"	.005	"	85	"	.003	"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: AGA
WITNESSED BY

72-354-2

24

LABORATORY DATA SHEET

TEST	CONTACT RETENTION (FIXED CONTACTS)
DATE OF TESTS	6-29-72
REPORT NUMBER	12-5193
TEST SPECIMEN (S)	L-27758-24 PLUG # 4 L-27758-25 RECEPTACLE # 4
LT.	3128
TEMP	74°
R.H.	48%
ECL	2540A-2B
SPEC.	L-15081-98
PARA.	6.6.2
TEST EQUIPMENT	INSTRON PC 1050
CAL. DATE	2-25-72
DUE DATE	8-25-72
SPEC. LIMITS	10 Lbs .012" displacement
TEST CONDITIONS	INITIAL RATE 1" / second

PLUG # 4				RECEPTACLE # 4		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	10 Lbs	.0035	inch	1	10 Lbs	*	
4	"	.003	"	4	"	.003	inch
8	"	.006	"	8	"	.003	"
18	"	.004	"	18	"	.003	"
22	"	.0035	"	22	"	.004	"
29	"	.004	"	29	"	.0035	"
35	"	.0035	"	35	"	.003	"
41	"	.0035	"	41	"	.002	"
48	"	.003	"	48	"	.004	"
57	"	.0035	"	57	"	.003	"
60	"	.004	"	60	"	.0025	"
72	"	.0055	"	72	"	.002	"
78	"	.0055	"	78	"	.0025	"
82	"	.006	"	82	"	.0025	"
85	"	.0045	"	85	"	.0025	"
				2	"	.0025	"
					"		

* Due to damaged pin #1, contact #2 was substituted.

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: [illegible]
WITNESSED BY

72-354-2

Engineering Laboratory Report

12-5194

PRE-PRODUCTION TESTING
BENDIX PROTOTYPE "STUB E"
INTERGRATED WIRE TERMINATION DEVICES

DATE OF TEST:	23 Oct 1972 to 20 Dec 1972
DATE OF REPORT:	2 February 1973
REPORTED BY:	Rudy A. Napolitano
APPROVED BY:	A.G. Armitage
APPROVED BY:	[illegible] 2/2/73
NOTED BY:	Donald H. Gould
NOTED BY:	Donald L. Pfendler

Bendix Electrical Components Division

Sidney, N.Y. 13838

ENGINEERING LABORATORY REPORT 12-5194

TABLE OF CONTENTS

		Page
I.	Purpose of Test	1
II.	Conclusions	1
III.	Recommendations	1-2
IV.	Action Taken	2-3
V.	Detailed Report	
	Test Samples, Test Sequence	4-5
	Examination of Product	5
	Wire and Prepare	5
	Operating Torques (Groups I, II, III)	5-6
	Insulation Resistance	6
	Dielectric Withstanding Voltage	6
	Contact Retention (Removable & Fixed)	6
	Maintenance Age (Group I)	7
	Contact Retention (Removable Only, Group I)	7
	Temperature Cycle (Group I)	7
	Vibration (Group I)	7-8
	Shock (Group I)	8
	Contact Resistance (Group I)	8-9
	Operating Torques (Group I)	9
	Fluid Immersion, Lube Oil (Group I)	9
	Operating Torques (Group I)	9
	Temperature Cycle (Group II)	9-10
	Insulation Resistance @ Elevated Temperature (Group II)	10
	Air Leakage (Group II)	10
	Contact Resistance (Group II)	10-11
	Operating Torques (Group II)	11
	Contact Retention (Removable & Fixed, Group II)	11
	Fluid Immersion, Hydraulic Oil (Group II)	11
	Operating Torques (Group II)	12
	Durability (Group III)	12
	Temperature Life (Group III)	12-13
	Operating Torques (Group III)	13
	Dielectric Withstanding Voltage (Group III)	13
	Contact Retention (Removable & Fixed, Group III)	13-14
	Insulation Resistance (Group III)	14
	Contact Resistance (Group III)	14
	Final Examination of Product (Groups I. II, III)	14-15
VI.	References	15
VII.	Appendices - A. Data Sheets	
	B. Bendix Test Procedure L-15081-98	

I. PURPOSE

To qualify Bendix L-27758-80 and -81 Stub E (Ordnance Document 11176551) electrical connectors, modified for inclusion of the integrated wire termination system. This qualification was made for the acceptance of this termination system to the applicable requirements of MIL-C-81511B as set forth by the USAECOM Contract DAAB07-71-C-0090.

II. CONCLUSIONS

The submitted connectors successfully met all of the requirements of Bendix Test Plan L-15081-98 with the following exceptions:

1. Initial visual examination disclosed some minor discrepancies such as excessive RTV sealant, poor plating in socket barrels and distorted grommet holes. These discrepancies would not be detrimental to testing. No major discrepancies were noted.

2. Operating Torques exceeded the specification limits. This was due to the addition of the second waved washer which was needed to gain more mating depth.

3. Several circuit resistance readings exceeded the specification limit. Other readings were higher than normal. The reason for abnormal readings was the improper positioning of the insert in the shells, causing a minimal effective electrical engagement.

4. Receptacle #9 had air leakage in excess of 182 cubic inches per hour. The leakage appeared to be between the insert and the shell.

5. Operating Torques after Temperature Life were extremely high. This was caused by the drying and flaking of all lubrication during Temperature Life.

6. Visual examination after Temperature Life disclosed discoloration of the plug shells and the hard dielectric inserts.

III. RECOMMENDATIONS

1. Further investigation should be conducted for sealing of these connectors. The RTV filler is apparently inadequate as a sealant for this design.

2. Investigation for a better lubricant should be explored. The present lubricant is not sufficient for a Temperature Life test at elevated temperatures.

III. RECOMMENDATIONS (Continued)

The present lubricant tends to dry and flake off, giving no lubrication to the coupling ramp mechanism. This causes extremely high operating forces.

IV. ACTION TAKEN

The assemblies containing various types of failures during the testing were inspected or disassembled and inspected to determine the cause of failure with the following observations and recommendations for corrective action.

A. Connector assembly #11, circuit #1, was intermittent during contact resistance testing.

1. Observations

a. The length of the fixed pin contact is shorter than required. It appears to have been machined too short.

2. Corrective Action

a. Components must be machined to required dimensions.

B. Receptacle assembly #9 had a leakage rate of 182 cubic inches per hour after exposure to the environments. Leakage appeared to be between the insert assembly and the shell.

1. Observations

a. The assembly was disassembled to inspect the area between the insert assembly and the shell. It was observed that there was less than acceptable adhesion between the RTV sealant and the dielectric terminal retention insert.

2. Corrective Action

a. In the recent past, at Bendix/ECD, a change has been made from RTV sealant per MIL-A-46146, Type I, to RTV sealant per MIL-A-46146, Type II. This is an improvement in adhesion to the P-360 (3M) material. If additional connector assemblies were to be made, the new sealant would be used.

IV. ACTION TAKEN (Continued)

C. Connector assemblies #11 and #12 turned a much lighter color (from a black color) during the Temperature Life test.

1. Observations

a. The greatestcolor change was on the plug assemblies with both coupling nuts, plug shells and adapters changing color. It was the opinion of Bendix/ECD personnel that the thickness of plating on these components was thinner than required by the component drawing.

2. Corrective Action

a. Although the color change of the plating is only cosmetic in nature (i. e. it did not cause any functional failures), the proper thickness of plating must be applied in the future.

Donald H. Gould

Donald H. Gould
Connector Engineering

V. DETAILED REPORT

A total of six mating pairs of connectors were submitted for this test program. The connectors were individually numbered and divided into three groups. There were identified as follows:

Test Sample Number	Bendix Part Number	Shell Configuration	Group Number
7, 8	L-27758-80	Plug	I
7, 8	L-27758-81	Receptacle	I
9, 10	L-27758-80	Plug	II
9, 10	L-27758-81	Receptacle	II
11, 12	L-27758-80	Plug	III
11, 12	L-27758-81	Receptacle	III

Due to the unavailability of Stub E shells from the manufacturer, the Stub E inserts were assembled in shells with MIL-C-26482 intermating dimensions.

All connectors were tested in accordance with Bendix Test Procedure L-15081-98, a copy of which is attached.

The connectors were subjected to the tests in the following sequence, in the order listed.

Test Sequence

Test	Par	Test Sample Groups I (7&8)	II (9&10)	III (11&12)
Examination of Product	6.1	x	x	x
Wire and Prepare	6.2	x	x	x
Operating Torques	6.3	x	x	x
Insulation Resistance	6.4	x	x	x
Dielectric W/Stding Voltage	6.5	x	x	x
Contact Retention (Remov&Fixed)	6.6	x	x	x
Maintenance Age	6.7	x		
Contact Retention (Remov Only)	6.6.1	x		
Temperature Cycle	6.8	x	x	
Vibration	6.9	x		
Shock	6.10	x		

V. DETAILED REPORT (Continued)

Test	Par	Test Sample Groups I (7&8)	II (9&10)	III (11&12)
Insul Resistance (Elev Temp)	6.13		x	
Air Leakage	6.14		x	
Contact Resistance	6.16	x	x	
Operating Torques	6.3	x	x	
Contact Retention (Remov&Fixed)	6.6		x	
Durability	6.18			x
Temperature Life	6.19			x
Fluid Immersion, Hydraulic Oil	6.20.1		x	
Fluid Immersion, Lube Oil	6.20.2	x		
Operating Torques	6.3	x	x	x
Dielectric W/Stding Voltage	6.5			x
Contact Retention (Remov&Fixed)	6.6			x
Insulation Resistance	6.4			x
Contact Resistance	6.16			x
Final Examination of Product	6.22	x	x	x

Examination of Product, Par 6.1

The individual connectors were visually inspected for conformance to the applicable Bendix assembly drawings and for suitability for evaluation of the design. Some minor defects were noted such as excessive RTV sealant, poor plating in socket barrels and distorted grommet holes. All of the defects noted would not be detrimental to the evaluation of the design.

Wire and Prepare, Par 6.2

Each removable socket termination was crimped to a three foot length of teflon insulated MIL-W-16878/4, 20 gauge wire, using an MS3198-1 (S/N 5781) crimp tool with an MS3198-9P positioner. The wired socket terminations were installed into the connector cavities using MS27509A20 insertion tools. All contacts were removed with MS27509R20 removal tools.

Groups I, II and III

Operating Torques, Par 6.3

Each plug was coupled to its counterpart receptacle and uncoupled at a slow, uniform rate. The initial peak force required to couple and uncouple the mating connectors was measured.

V. DETAILED REPORT (Continued)

All forces were within the specified 25 inch-pound limit. Recorded forces are included on Data Sheet 1.

Insulation Resistance, Par 6.4

The insulation resistance of the mated connectors was measured between each contact and all other contacts and shell tied electrically in common. The measurements were made at a test potential of 500 volts dc ±10% and the electrification time was less than two minutes per circuit. All circuits had an insulation resistance greater than 10,000 megohms. This test was conducted on the automatic connector tester F-1680 calibrated 10/10/72.

Dielectric Withstanding Voltage, Par 6.5

The mated connectors had a potential of 1500 volts ac rms at 60 Hz applied between each contact and all other contacts and shell connected electrically in common for a period of two seconds per circuit. Any leakage current in excess of one milliampere was considered a failure. There were no electrical flashovers or breakdowns noted. The test was conducted on the automatic connector tester F-1680 calibrated 10/10/72.

Contact Retention, Par 6.6

Removable Contacts, Par 6.6.1

Fifteen contacts, randomly selected, were removed and replaced with a specially made test contact. This special contact incorporated its own retention member release sleeve and had a body long enough to allow the load to be applied. A load (tensile) of 15 pounds was applied at a rate of approximately one pound per second and monitored for a time period of 5-10 seconds. In all cases the retention mechanism tested held the special contact. The maximum displacement was .007". Precise data is on Data Sheets 2-7 attached.

Fixed Contacts, Par 6.6.2

Fifteen fixed contacts, the same contact numbers used for the Removable Contact Retention test, had a load of 15 pounds applied to their mating end at a rate of approximately one pound per second and monitored for a period of 5-10 seconds. The maximum displacement was .007". Precise load data and displacement can be obtained from attached Data Sheets 8-13.

V. DETAILED REPORT (Continued)

Group I Tests, Samples #7 and #8

Maintenance Age, Par 6.7

Each removable contact was removed from and reinserted into its individual insert cavity using MS27509A20 insertion and MS27509R20 removal tools. The 15 contacts already subjected to contact retention were removed and reinserted an additional nine times. The forces to insert and remove these contacts were measured on the first and ninth cycles. The maximum insertion force was 5-3/4 pounds initially and 3-1/2 pounds on the ninth cycle. The minimum removal force was 3/4 of a pound both initially and on the ninth cycle. Refer to Data Sheets 14-17.

Contact Retention, Removable Contacts, Par 6.6.1

The same 15 contacts which were previously tested were again removed and replaced with the special steel contact for contact retention. The test was performed in the same manner as previously described. All retention mechanisms held the special contact and the maximum displacement was .0055". Recorded data is on Data Sheets 18, 19.

Temperature Cycle, Par 6.8

The unmated connectors were subjected to five continuous cycles of temperature shock. Each cycle consisted of one-half hour at -65°C. (-85°F.) followed by one-half hour at +175°C. (+347°F.). The elapsed time between the temperature extremes was less than two minutes. At the end of the test, a visual examination disclosed no damage detrimental to the operation of the connectors.

Vibration, Par 6.9

During the series wiring of the Group I samples for vibration, a discontinuity occurred when the mated connectors were flexed. An investigation into this problem revealed the connectors were not fully mating. A second waved washer was added to the vibration samples to increase the mating depth.

Operating forces were measured after the addition of the second waved washer and the forces were increased by approximately 20 to 33 inch pounds mating and unmating. The forces, although increased, gave a more stable main joint and no further discontinuities were noticed.

V. DETAILED REPORT (Continued)

A later investigation disclosed improper positioning of the Stub E inserts in the MIL-E-26482 type connector shells. This caused a minimal electrical engagement of the main joint contacts. Recorded forces are on Data Sheet 20.

The mated connectors were rigidly mounted on a vibration exciter using a suitable vibration test fixture and their normal mounting means. A minimum of 8" of wire was unsupported on both ends of the connectors. The connectors were subjected to a vibration level of 20g peak. The vibration frequency was varied logarithmically between 10 and 2000 Hz and back to 10 Hz in a period of 20 minutes. The vibration sweep was applied 12 times (4 hours) in each of three mutually perpendicular axes. Each four-hour period was conducted at one hour at -65°C. (-85°F.), two hours at room temperature and one hour at +175°C. (+347°F.). During vibration, the series wired contacts were monitored for discontinuities at 100 milliamperes dc. There was no discontinuity of one microsecond or greater. Refer to Data Sheets 21, 22.

Shock, Par 6.10

The mated connectors were rigidly mounted on a shock test machine using a suitable test fixture and their normal mounting means. A minimum of 8" of wire was unsupported on both ends of the connectors. The connectors were subjected to one shock pulse in each direction of each of the three mutually perpendicular axes. Each pulse was approximately half-sine waveform, 50g peak and 11 milliseconds in duration. The series wired contacts were monitored for discontinuities at 100 ma. There were no discontinuities in excess of one microsecond. Results are recorded on Data Sheet 23.

Contact Resistance, Par 6.16

The resistance of 25 contact sets of each mated connector was measured. The four wire method of MIL-C-23216C was used. The voltage drop across a 6" length (mated contacts approximately in the middle) was measured at a test current of 7-1/2 amperes dc.

Due to the minimum amount of electrical engagement of the main joint contacts, erratic and intermittent readings occurred. Some circuits in connector #7 exceeded the 60 millivolt specificatication limits. An investigation disclosed the problem to be in the main joint area and not in the terminating area.

V. DETAILED REPORT (Continued)

This was confirmed by taking a single pin and socket contact soldered to a three foot length of 20 AWG wire and measuring the failing circuits of the unmated connector halves. All circuits passed the 60 millivolt specification limit. The maximum was 47 millivolts.

A spot check of several circuits that previously had passed were measured for comparison purposes. The data obtained on these circuits was comparable to the results of the failing circuits. Therefore, it is the opinion of this laboratory that the problem is in the main joint area and not in the terminating area. Refer to Par 6.9 (this report) where electrical engagement problems were encountered. Recorded data of all potential drop readings can be obtained from Data Sheets 24, 25.

Operating Torques, Par 6.3

Each plug was coupled to its counterpart receptacle and uncoupled at a slow, uniform rate. The peak torques were measured and recorded. These forces exceeded the specification limit due to the use of the double waved washers. Refer to Data Sheet 26.

Fluid Immersion, Lube Oil MIL-L-23699, Par 6.20.2

The unmated connectors were immersed in the lubricating oil at room temperature for 20 hours. The parts were then allowed to drain for one hour at room temperature. A visual examination disclosed no swelling of the components in the connectors. The connectors were then subjected to the subsequent tests.

Operating Torques, Par 6.3

The operating torques were again measured as previously described and the peak coupling and uncoupling forces were recorded. Again the forces exceeded the specification limits due to the double waved washer. Refer to Data Sheet 27.

Group II Tests, Samples #9, #10

Temperature Cycle, Par 6.8

The unmated connectors were subjected to five continuous cycles of temperature shock. Each cycle consisted of one-half hour at -65°C. (-85°F.) followed by one-half hour at +175°C. (+347°F.). The elapsed time between temperature extremes was less than two minutes.

V. DETAILED REPORT (Continued)

At the conclusion of the test, visual examination disclosed no detrimental effects to any of the connectors as a result of the temperature cycle test. Due to the problem previously mentioned in Group I, pertaining to the minimum amount of electrical engagement of the main joint contacts, the second waved washer was added to the Group II test samples at this time. Operating torques were measured after temperature cycling. Results are included on Data Sheet 20.

Insulation Resistance @ Elevated Temperature, Par 6.13

The insulation resistance of the mated connectors was measured between each of 12 contacts and all other contacts and shell tied electrically in common. Six of the contacts were adjacent to the shell. These measurements were recorded after the connectors were subjected to a temperature of +175°C. (+347°F.) for 30 minutes. The measurements were made at a test potential of 500 volts dc and the electrification time did not exceed two minutes per circuit. All circuits had an insulation resistance greater than 5000 megohms. Insulation resistance was measured with a General Radio megohm bridge, F-1514, calibrated 8/29/72. Results are on Data Sheets 28, 29.

Air Leakage, Par 6.14

Each wired, unmated plug and receptacle were mounted on a test fixture suitable for application of a pressure of 30 psig to the mating face. The connectors and wires were immersed in Neosol so that any leakage was visually observed as bubbles. The assembly was soaked at a temperature of -65°C. (-85°F.) and then pressurized to 30 psig. Leakage, if any, was measured by collecting the bubbles in an inverted Neosol-filled, graduated cylinder.

Receptacle #9 had a leakage rate of 182 cubic inches per hour. The leakage appeared to be between the insert and the shell. Later investigation disclosed two voids between the filler and the shell where the leakage occurred. There was no visible leakage on any of the other connectors. Refer to Data Sheet 30.

Contact Resistance, Par 6.16

The resistance of 25 contact sets of each mated connector was measured. The four wire method of MIL-C-23216C was used. The voltage drop across a 6" length (mated contacts approximately in the middle) was measured at a test current of 7-1/2 amperes dc.

V. DETAILED REPORT (Continued)

Due to the minimum amount of electrical engagement of the main joint contacts, as described in the Group I tests, erratic and intermittent readings occurred. Six circuits in connector #9 and one circuit in connector #10 exceeded the 60 millivolt limit. Results of all potential drop readings can be obtained from Data Sheets 31, 32.

Operating Torques, Par 6.3

Each plug was coupled to its counterpart receptacle and uncoupled at a slow, uniform rate. The peak torques were measured and recorded. The torques again exceeded the specification limit due to the double waved washer. Recorded data is included on Data Sheet 26.

Contact Retention, Par 6.6

Removable Contacts, Par 6.6.1

Fifteen contacts were removed and replaced with a specially made test contact for contact retention. This special contact incorporated its own retention member release sleeve and had a body long enough to allow the load to be applied. A load (tensile) of 15 pounds was applied at a rate of approximately one pound per second and monitored for a time period of 5-10 seconds. Each retention mechanism tested held the special contact. The maximum displacement was .0085". Refer to Data Sheets 33, 34.

Fixed Contacts, Par 6.6.2

Fifteen fixed contacts, same contact numbers used above in each connector half, had a load of 15 pounds applied to their mating ends at a rate of approximately one pound per second and monitored for a period of 5-10 seconds. The maximum displacement was .005". Load data and displacement can be obtained from Data Sheets 35, 36.

Fluid Immersion, Hydraulic Oil, MIL-H-5606, Par 6.20.1

The unmated connectors were immersed in the hydraulic oil at room temperature for 20 hours. The parts were allowed to drain for one hour at room temperature. Visual examination disclosed no swelling of the components in the connectors. The connectors were then subjected to the subsequent tests.

V. DETAILED REPORT (Continued)

Operating Torques, Par 6. 3

The operating torques were again measured as previously described and the peak coupling and uncoupling forces were recorded. Forces were again above the specification limit due to the double waved washer. Refer to Data Sheet 27.

Group III Tests, Samples #11 and #12

Durability, Par 6. 18

The mated connectors were subjected to 200 cycles of mating and unmating at a maximum rate of 200 cycles per hour. The coupling mechanism was operated in a manner to simulate actual service operation with the receptacle securely mounted.

Visual examination after the 200 cycles of mating and unmating showed very little wear on the pin contact mating ends. This is believed due to the minimum amount of electrical engagement caused by the improper positioning of the Stub E inserts in the MIL-C-26482 type connector shells. The coupling mechanism in both connectors disclosed a small amount of wear, mainly in the coupling ramps. This wear is not abnormal for the number of cycles the connectors were subjected to. The connectors showed no mechanical or electrical defects detrimental to the operation of the connectors.

At this time the second waved washer was introduced to the Group III test samples. The operating torques were measured before and after the addition of the second waved washer. The recorded forces are included on Data Sheet 37.

Temperature Life, Par 6. 19

The unmated connectors were subjected to a temperature of +175°C. (347°F.) for a period of 1000 hours. At the end of the 1000-hour test and while at 175°C., the insulation resistance was measured between each of 12 contacts and all other contacts and shell tied electrically in common. Six of the contacts were adjacent to the shell. The measurements were made at a test potential of 500 volts dc and electrification time was less than two minutes per circuit. All circuits had an insulation resistance greater than 170,000 megohms. Insulation resistance was measured with a General Radio megohm bridge, F-0555, calibrated 6/6/72.

V. DETAILED REPORT (Continued)

Visual examination after temperature life disclosed the hard dielectric inserts had discolored. This is not abnormal and is to be expected after a 1000-hour heat aging test. All lubrication in the coupling mechanism had dried and flaked off. The plating on both the plug shells and coupling nuts had discolored during the temperature life test. The plating on the receptacle shells showed less discoloration than the plug shells. The discoloration of plating on the receptacle shells appeared to be normal for this type of plating after being subjected to 1000 hours heat age at 347°F. Refer to Data Sheets 38, 39.

Operating Torques, Par 6.3

Each plug was coupled and uncoupled with its counterpart receptacle. The initial force required to couple and uncouple the mating connectors was measured. The operating forces were greatly increased over the forces recorded after the addition of the second waved washer. This is attributed to the absence of lubrication due to the Temperature Life test. A 40 to 60 inch pound increase was recorded. Complete results are on Data Sheet 40.

Dielectric Withstanding Voltage, Par 6.5

The mated connectors had a potential of 1500 volts ac rms, 60 Hz, applied between each contact and all other contacts and shell connected electrically in common. Electrification time was two seconds per circuit. Any leakage current in excess of one milliampere was considered a failure. There were no electrical flashovers or breakdowns noted. This test was conducted on the automatic connector tester, F-1680, calibrated 12/6/72.

Contact Retention, Par 6.6

Removable Contacts, Par 6.6.1

Fifteen contacts randomly selected were removed and replaced with a specially made test contact. This special contact incorporated its own retention member release sleeve and had a body long enough to allow the load to be applied. A load (tensile) of 15 pounds was applied at a rate of approximately one pound per second and monitored for a time period of 5-10 seconds. In all cases the retention mechanism retained the special contact. The maximum displacement was .007". Data and displacement can be obtained from Data Sheets 41, 42.

V. DETAILED REPORT (Continued)

Fixed Contacts, Par 6.6.2

Fifteen fixed contacts, the same contact numbers used for the removable contact retention test, had a load of 15 pounds applied to their mating end at a rate of approximately one pound per second and monitored for a period of 5-10 seconds. The maximum displacement was .0045". For complete results see Data Sheets 43, 44.

Insulation Resistance, Par 6.4

The insulation resistance of the mated connectors was measured between each contact and all other contacts and shell tied electrically in common. The measurements were made at a test potential of 500 volts dc and the electrification time did not exceed two minutes per circuit. All values were greater than 5000 megohms. This test was conducted on the automatic connector tester, F-1680, calibrated 12/6/72.

Contact Resistance, Par 6.16

The resistance of 25 contact sets of each mated connector was measured. The four wire method of MIL-C-23216C was used. The voltage drop across a 6" length (mated connectors approximately in the middle) was measured at a test current of 7-1/2 amperes dc. The maximum allowable potential drop is 70 millivolts after the temperature life conditioning. All circuits in connector #12 were within the 70 mv limit. Connector #11 had three circuits exceed the specified limit. This is attributed to the minimal electrical engagement.

Circuit #1 was an intermittent circuit. An investigation into this problem disclosed this contact was incorrectly positioned in the insert. Therefore, only the socket hood completed the electrical circuit. Data on all potential drop readings can be obtained from Data Sheets 45, 46.

Final Examination of Product, Par 6.22

At the completion of all testing, the connectors were visually examined for general conditions and any damage which would be considered abnormal for the tests to which the connectors were exposed.

The identification markings on all connector shells and the screen printing on all insert faces was clear and legible.

V. DETAILED REPORT (Continued)

The hard dielectric inserts of the Group III samples had discolored after the 1000-hour heat aging. The plating on both plug shells of this group had discolored. All lubrication had baked off during the Temperature Life test.

The mechanical and electrical capabilities of all connectors was satisfactory at the completion of all tests.

Due to the high operating forces and the absence of lubrication after the Temperature Life test, plug #12 was lubricated with Uni-Temp 9-3502. The operating forces were then measured and were considerably lower than the forces recorded after Temperature Life. This then proves the lack of lubricant on the coupling mechanism after temperature life contributed to the extremely high forces.

VI. REFERENCES

Bendix Test Procedure L-15081-98, April 1972
MIL-C-23216C
ECL-0507, 92-102; ECL-0507B
ECL-0545, 4-9; ECL-0545A
CLT 3219, Job 05950-03, ₵74535

APPENDIX A

DATA SHEETS

LABORATORY DATA SHEET

TEST: OPERATING FORCES			DATE OF TESTS: 10-23-72	REPORT NUMBER: 12-5194	
TEST SPECIMEN (S): L-27758-80 PLUGS MATED WITH L-27758-81 RECEPTACLES		LT. 3219	TEMP. 74°F	R.H. 34%	ECL 05078-93
			SPEC. L-15081-98	PARA. 6.3	
TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS MAX. ENG.& DIS-ENGAGE - 25 IN.-lbs.		
STURTEVANT TORQUE FIXTURE	N/A		TEST CONDITIONS Room AmBient INITIAL		
STURTEVANT TORQUE WRENCH PG-1178	10-16-72	1-16-73			

L-27758-80 #7 mated with L-27758-81 #7

MATING FORCE	UNMATING FORCE
8 lbs.-IN	17 lbs.-IN

L-27758-80 #8 mated with L-27758-81 #8

MATING FORCE	UNMATING FORCE
7½ lbs-IN	15 lbs.-IN

L-27758-80 #9 mated with L-27758-81 #9

MATING FORCE	UNMATING FORCE
6 lbs.-IN	12 lbs.-IN

L-27758-80 #10 mated with L-27758-81 #10

MATING FORCE	UNMATING FORCE
7 lbs.-IN	17 lbs.-IN

L-27758-80 #11 mated with L-27758-81 #11

MATING FORCE	UNMATING FORCE
7½ lbs.-IN	16¾ lbs-IN

L-27758-80 #12 mated with L-27758-81 #12

MATING FORCE	UNMATING FORCE
8 lbs.-IN	18½ lbs-IN

REF. SINGLE WAVE WASHER	Bendix Electrical Components Division, Sidney, New York 13838	TESTED BY T.A. NAPOLITANO
		APPROVED BY [signature]
		WITNESSED BY

72-354-2

1

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - REMOVABLE		DATE OF TESTS: 10-25-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #7		TEMP: 74°F R.H.: 34%	ECL ET: 05078-96
L-27758-81 RECEPTACLE #7	LT. 3219	SPEC. L-15081-98	PARA. 6.6.1
TEST EQUIPMENT: INSTRON PG 1050	CAL. DATE 8-25-72 DUE DATE 2-25-73	SPEC. LIMITS: 15 lbs. .012" displacement	
		TEST CONDITIONS: INITIAL RATE 1 lb/second	

	58-80	#7 PLUG		-58-81	#7 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.003	inch	1	15 lbs.	.0055	inch
7	"	.0025	"	7	"	.0045	"
10	"	.0025	"	10	"	.003	"
14	"	.003	"	14	"	.004	"
20	"	.003	"	20	"	.003	"
25	"	.0035	"	25	"	.005	"
28	"	.005	"	28	"	.003	"
32	"	.003	"	32	"	.0035	"
36	"	.003	"	36	"	.0035	"
40	"	.002	"	40	"	.004	"
45	"	.006	"	45	"	.004	"
48	"	.0035	"	48	"	.003	"
51	"	.004	"	51	"	.004	"
53	"	.004	"	53	"	.0045	"
55	"	.004	"	55	"	.003	"

REF. Group I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: [illegible signature]
WITNESSED BY:

72-354-2

2

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - REMOVABLE			DATE OF TESTS: 10-25-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-Z7758-80 PLUG #8			TEMP: 74°F R.H.: 34%	ECL: 05028-97
L-Z7758-81 RECEPTACLE #8		LT. 3219	SPEC.: L-15081-98	PARA.: 6.6.1
TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS: 15 lbs. .012" displacement	
INSTRON PG 1050	8-25-72	2-25-73	TEST CONDITIONS: INITIAL	
			RATE 1lb/second	

	58-80	#8 PLUG			58-81	#8 RECEPTACLE	
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0025	inch	1	15 lbs	.0025	inch
7	"	.003	"	7	"	.0025	"
10	"	.002	"	10	"	.003	"
14	"	.002	"	14	"	.003	"
20	"	.002	"	20	"	.0035	"
25	"	.0045	"	25	"	.003	"
28	"	.002	"	28	"	.003	"
32	"	.003	"	32	"	.003	"
36	"	.003	"	36	"	.004	"
40	"	.003	"	40	"	.0025	"
45	"	.002	"	45	"	.0045	"
48	"	.0025	"	48	"	.0035	"
51	"	.0035	"	51	"	.004	"
53	"	.006	"	53	"	.003	"
55	"	.0055	"	55	"	.004	"

REF. GROUP I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: [signature]
WITNESSED BY

72-354-2

3

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - REMOVABLE			DATE OF TESTS: 10-25-72		REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #9			TEMP. 74°F	R.H. 34%	ECL 05078-98
L-27758-81 RECEPTACLE #9		LT. 3219	SPEC. L-15081-98		PARA. 6.6.1
TEST EQUIPMENT: INSTRON PG 1050	CAL. DATE 8-25-72	DUE DATE 2-25-73	SPEC. LIMITS 15 lbs. .012" displacement		
			TEST CONDITIONS: INITIAL		
			RATE 1 #/SECOND		

	58-80 #9	PLUG			58-81 #9	RECEPTACLE	
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0035 inch		1	15 lbs.	.004 inch	
7	"	.007	"	7	"	.003	"
10	"	.005	"	10	"	.0035	"
14	"	.0035	"	14	"	.0045	"
20	"	.004	"	20	"	.003	"
25	"	.002	"	25	"	.0045	"
28	"	.003	"	28	"	.0065	"
32	"	.003	"	32	"	.0045	"
36	"	.005	"	36	"	.003	"
40	"	.0025	"	40	"	.0025	"
45	"	.0025	"	45	"	.0045	"
48	"	.0025	"	48	"	.0055	"
51	"	.002	"	51	"	.0045	"
53	"	.0035	"	53	"	.003	"
55	"	.003	"	55	"	.0025	"

REF. GROUP II	Bendix Electrical Components Division, Sidney, New York 13838	TESTED BY: T.A. NAPOLITANO
		APPROVED BY: [signature]
		WITNESSED BY

72-354-2

4

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - REMOVABLE			DATE OF TESTS: 10-25-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG # 10			TEMP. 74°F / R.H. 54%	ECL 05078-99
L-27758-81 RECEPTACLE #10		LT. 3219	SPEC. L-15081-98	PARA. 6.6.1
TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS: 15 lbs. .012" displacement	
INSTRON PC 1050	8-25-72	2-25-73	TEST CONDITIONS: INITIAL	
			RATE 1lb/second	

	58-80 #10 PLUG				58-81 #10 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0025	inch	1	15 lbs.	.0025	inch
7	"	.002	"	7	"	.0025	"
10	"	.0015	"	10	"	.003	"
14	"	.002	"	14	"	.003	"
20	"	.0015	"	20	"	.0025	"
25	"	.002	"	25	"	.0035	"
28	"	.0025	"	28	"	.0025	"
32	"	.0025	"	32	"	.003	"
36	"	.002	"	36	"	.0025	"
40	"	.003	"	40	"	.004	"
45	"	.002	"	45	"	.003	"
48	"	.003	"	48	"	.003	"
51	"	.003	"	51	"	.003	"
53	"	.002	"	53	"	.0045	"
55	"	.0025	"	55	"	.0035	"

REF. GROUP II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. NAPOLITANO
APPROVED BY: TAA
WITNESSED BY

72-354-2

5

LABORATORY DATA SHEET

TEST	CONTACT RETENTION - REMOVABLE
DATE OF TESTS	10-25-72
REPORT NUMBER	12-5194
TEST SPECIMEN (S)	L-27758-80 PLUG #11; L-27758-81 RECEPTACLE #11
LT.	3219
TEMP.	74°F
R.H.	34%
ECL	05076-100
SPEC.	L-15081-98
PARA.	6.6.1
TEST EQUIPMENT	INSTRON PC-1050
CAL. DATE	8-25-72
DUE DATE	2-25-73
SPEC. LIMITS	15 lbs. .012" displacement
TEST CONDITIONS	INITIAL; RATE 1 lb/second

58-80 #11 PLUG				58-81 #11 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT
1	15 lbs.	.002 inch		1	15 lbs.	.0025 inch
7	"	.002 "		7	"	.003 "
10	"	.003 "		10	"	.003 "
14	"	.0015 "		14	"	.003 "
20	"	.0025 "		20	"	.003 "
25	"	.0025 "		25	"	.0025 "
28	"	.0025 "		28	"	.0035 "
32	"	.002 "		32	"	.003 "
36	"	.003 "		36	"	.0035 "
40	"	.003 "		40	"	.002 "
45	"	.0035 "		45	"	.0035 "
48	"	.002 "		48	"	.003 "
51	"	.002 "		51	"	.003 "
53	"	.0035 "		53	"	.0035 "
55	"	.0035 "		55	"	.0045 "

REF. GROUP III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY J. A. Napolitano

APPROVED BY [signature]

WITNESSED BY

6

72-354-2

LABORATORY DATA SHEET

TEST	CONTACT RETENTION- REMOVABLE
DATE OF TESTS	10-25-72
REPORT NUMBER	12-5194
TEMP.	74°F
R.H.	34%
ECL	05078-101
TEST SPECIMEN (S)	L-22758-80 PLUG #12; L-22758-81 RECEPTACLE #12
LT.	3219
SPEC.	L-15081-98
PARA.	6.6.1
TEST EQUIPMENT	INSTRON PG-1050
CAL. DATE	8-25-72
DUE DATE	2-25-73
SPEC. LIMITS	15 lbs. .012" displacement
TEST CONDITIONS	INITIAL; RATE 1lb/second

58-80 #12 PLUG				58-81 #12 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.002 inch		1	15 lbs.	.004 inch
7	"	.002	"	7	"	.0045	"
10	"	.0025	"	10	"	.003	"
14	"	.002	"	14	"	.004	"
20	"	.003	"	20	"	.004	"
25	"	.0025	"	25	"	.002	"
28	"	.0015	"	28	"	.002	"
32	"	.002	"	32	"	.004	"
36	"	.002	"	36	"	.004	"
40	"	.0035	"	40	"	.003	"
45	"	.002	"	45	"	.0035	"
48	"	.003	"	48	"	.0035	"
51	"	.003	"	51	"	.0055	"
53	"	.0025	"	53	"	.0045	"
55	"	.0015	"	55	"	.0045	"

REF. GROUP III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY J.A. NAPOLITANO
APPROVED BY [illegible]
WITNESSED BY

7

72-354-2

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - FIXED	DATE OF TESTS: 10-26-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #7	TEMP. 75°F R.H. 34%	ECL 05078-102
L-27758-81 RECEPTACLE #7 LT. 3219	SPEC. L-15081-98	PARA. 6.6.2
TEST EQUIPMENT: INSTRON PG-1050 CAL. DATE 8-25-72 DUE DATE 2-25-23	SPEC. LIMITS 15 lbs. .012" displacement	
	TEST CONDITIONS: INITIAL RATE 1 lb/second	

	58-80 #7	PLUG			58-81 #7	RECEPTACLE	
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0025 inch		1	15 lbs.	.0025 inch	
7	"	.003	"	7	"	.004	"
10	"	.003	"	10	"	.003	"
14	"	.004	"	14	"	.0055	"
20	"	.004	"	20	"	.004	"
25	"	.005	"	25	"	.004	"
28	"	.0025	"	28	"	.0035	"
32	"	.004	"	32	"	.004	"
36	"	.003	"	36	"	.0025	"
40	"	.003	"	40	"	.003	"
45	"	.003	"	45	"	.0055	"
48	"	.0035	"	48	"	.0055	"
51	"	.005	"	51	"	.005	"
53	"	.004	"	53	"	.005	"
55	"	.003	"	55	"	.0045	"

REF. GROUP I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

8

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - FIXED			DATE OF TESTS: 10-26-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #8			TEMP. 75°F R.H. 34%	ECL: 05078-103
L-27758-81 RECEPTACLE #8		LT. 3219	SPEC. L-15081-98	PARA. 6.6.2
TEST EQUIPMENT: INSTRON PG-1050	CAL. DATE: 8-25-72	DUE DATE: 2-25-73	SPEC. LIMITS: 15 lbs. .012" displacement	
			TEST CONDITIONS: INITIAL RATE 1lb/second	

	58-80 #8 PLUG				58-81 #8 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0035 inch		1	15 lbs.	.002 inch	
7	"	.0045	"	7	"	.0025	"
10	"	.004	"	10	"	.003	"
14	"	.003	"	14	"	.002	"
20	"	.004	"	20	"	.003	"
25	"	.0045	"	25	"	.003	"
28	"	.0045	"	28	"	.004	"
32	"	.0035	"	32	"	.003	"
36	"	.003	"	36	"	.0035	"
40	"	.0045	"	40	"	.005	"
45	"	.004	"	45	"	.0055	"
48	"	.0045	"	48	"	.003	"
51	"	.004	"	51	"	.0025	"
53	"	.0045	"	53	"	.004	"
55	"	.0045	"	55	"	.0035	"

REF. GROUP I	Bendix Electrical Components Division, Sidney, New York 13838	TESTED BY: T. A. NAPOLITANO APPROVED BY: [signature] WITNESSED BY:

72-354-2

9

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
CONTACT RETENTION - FIXED	10-26-72	12-5194
TEST SPECIMEN (S) L-27758-80 PLUG #9	TEMP 74°F R.H. 34%	ECL 05078-104
L-27758-81 RECEPTACLE #9 LT. 3219	SPEC. L-15081-98	PARA. 6.6.2

TEST EQUIPMENT		CAL. DATE	DUE DATE	SPEC. LIMITS
INSTRON	PG-1050	8-25-72	2-25-73	15 lbs. .012" displacement

TEST CONDITIONS
INITIAL

RATE 1 lb/second

58-80 #9 PLUG				58-81 #9 RECEPTACLE			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs	.0035 inch		1	15 lbs	.0025 inch	
7	"	.0035	"	7	"	.003	"
10	"	.004	"	10	"	.004	"
14	"	.005	"	14	"	.003	"
20	"	.003	"	20	"	.004	"
25	"	.004	"	25	"	.0025	"
28	"	.006	"	28	"	.004	"
32	"	.003	"	32	"	.0025	"
36	"	.004	"	36	"	.0035	"
40	"	.0045	"	40	"	.003	"
45	"	.0045	"	45	"	.0045	"
48	"	.006	"	48	"	.003	"
51	"	.004	"	51	"	.002	"
53	"	.004	"	53	"	.003	"
55	"	.0035	"	55	"	.003	"

REF. Group II

Bendix Electrical Components Division
Sidney New York 13839

TESTED BY J. A. NAPOLITANO
APPROVED BY [illegible]
WITNESSED BY

72-354-2

10

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - FIXED		DATE OF TESTS: 10-26-72		REPORT NUMBER: 72-5194
TEST SPECIMEN (S): L-27758-80 PLUG #10		TEMP: 74°	R.H.: 34%	ECL: 05078-105
L-27758-81 RECEPTACLE #10	LT.: 3219	SPEC.: L-15081-98		PARA.: 6.6.2
TEST EQUIPMENT: INSTRON PG-1050	CAL. DATE: 8-25-72 / DUE DATE: 2-25-73	SPEC. LIMITS: 15 lbs .012" displacement		
		TEST CONDITIONS: INITIAL RATE 1 lb/second		

	58-80 #10 PLUG				58-81 #10 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.003	inch	1	15 lbs.	.002	inch
7	"	.0025	"	7	"	.003	"
10	"	.0035	"	10	"	.003	"
14	"	.0035	"	14	"	.0025	"
20	"	.003	"	20	"	.003	"
25	"	.0035	"	25	"	.0045	"
28	"	.004	"	28	"	.004	"
32	"	.0035	"	32	"	.0025	"
36	"	.003	"	36	"	.003	"
40	"	.003	"	40	"	.003	"
45	"	.0035	"	45	"	.004	"
48	"	.0035	"	48	"	.004	"
51	"	.003	"	51	"	.0025	"
53	"	.003	"	53	"	.002	"
55	"	.004	"	55	"	.003	"

REF. Group II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: [illegible]
WITNESSED BY

72-354-2

11

LABORATORY DATA SHEET

TEST	CONTACT RETENTION - FIXED
TEST SPECIMEN (S)	L-27758-80 PLUG #11 L-27758-81 RECEPTACLE #11
LT.	3219
TEST EQUIPMENT	INSTRON PG-1050
CAL. DATE	8-25-72
DUE DATE	2-25-73
DATE OF TESTS	10-26-72
REPORT NUMBER	12-5194
TEMP.	75°F
R.H.	34%
ECL	05076-106
SPEC.	L-15081-98
PARA.	6.6.2
SPEC. LIMITS	15 lbs. .012" displacement
TEST CONDITIONS	INITIAL RATE 1 lb/second

58-80 #11 PLUG				58-81 #11 RECEPTACLE			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0035	inch	1	15 lbs.	.0025	inch
7	"	.003	"	7	"	.004	"
10	"	.0035	"	10	"	.002	"
14	"	.0035	"	14	"	.0035	"
20	"	.0035	"	20	"	.0025	"
25	"	.003	"	25	"	.003	"
28	"	.004	"	28	"	.002	"
32	"	.0045	"	32	"	.003	"
36	"	.0045	"	36	"	.003	"
40	"	.004	"	40	"	.003	"
45	"	.004	"	45	"	.0045	"
48	"	.0065	"	48	"	.002	"
51	"	.0045	"	51	"	.002	"
53	"	.004	"	53	"	.0035	"
55	"	.0035	"	55	"	.003	"

REF. GROUP III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY J. A. NAPOLITANO
APPROVED BY [illegible]
WITNESSED BY

72-354-2

12

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - FIXED			DATE OF TESTS: 10-26-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #12			TEMP. 75°F · R.H. 34%	ECL 05078-107
L-27758-81 RECEPTACLE #12		LT. 2219	SPEC. L-15881-98	PARA. 6.6.2
TEST EQUIPMENT: INSTRON PB1050	CAL. DATE 8-25-72	DUE DATE 2-25-73	SPEC. LIMITS 15 lbs. .012" displacement	
			TEST CONDITIONS: INITIAL RATE 1lb/SECOND	

	58-80 #12	PLUG			58-81 #12	RECEPTACLE	
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.002	inch	1	15 lbs.	.0045	inch
7	"	.0025	"	7	"	.006	"
10	"	.0035	"	10	"	.002	"
14	"	.004	"	14	"	.003	"
20	"	.003	"	20	"	.006	"
25	"	.004	"	25	"	.002	"
28	"	.003	"	28	"	.003	"
32	"	.003	"	32	"	.0035	"
36	"	.003	"	36	"	.0055	"
40	"	.003	"	40	"	.0045	"
45	"	.004	"	45	"	.0025	"
48	"	.004	"	48	"	.005	"
51	"	.003	"	51	"	.0045	"
53	"	.004	"	53	"	.0035	"
55	"	.003	"	55	"	.007	"

REF. GROUP III

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY: J. A. NAPOLITANO
APPROVED BY: [illegible]
WITNESSED BY

72-354-2

13

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
CONTACT INSERTION & REMOVAL FORCES	10-26-72	12-5194

TEST SPECIMEN (S)	LT.	TEMP.	R.H.	ECL	SPEC.	PARA.
L-27758-80 PLUG #8	3219	75°F	34%	05076-108	L-15081-98	6.7

TEST EQUIPMENT		CAL. DATE	DUE DATE
DAYTRONIC STRAIN GAGE	E-4011	PRIOR TO	USE
ELECTRONIK-19	E-1366	9-12-72	12-7-72
"D" LOAD CELL		PRIOR TO	USE

SPEC. LIMITS

TEST CONDITIONS Room Ambient

	1ST		9TH	
CONTACT	INSERTION	REMOVAL	INSERTION	REMOVAL
1	5 lbs.	2 1/4 lbs.	2 1/4 lbs	1 lbs
7	4 lbs	1 1/2 lbs	3 lbs	1 1/2 lb
10	3 3/4 lbs	2 lbs	3 lbs	1 3/4 lbs
14	4 1/4 lbs	2 lbs	2 1/2 lb	3/4 lb
20	4 lbs	2 1/4 lbs	2 3/4 lbs	1 1/2 lbs
25	4 1/4 lbs	1 1/2 lbs	3 lbs	1 1/4 lbs
28	4 3/4 lbs	1 3/4 lbs	2 3/4 lbs	1 1/2 lbs
32	4 1/2 lbs	1 3/4 lbs	2 1/2 lbs	1 lb
36	4 lbs	1 1/2 lbs	2 1/2 lbs	1 lb
40	4 lbs	1 3/4 lbs	2 1/2 lb	3/4 lb
45	4 1/4 lbs	1 1/2 lbs	3 1/4 lbs	2 1/4 lbs
48	4 1/2 lbs	1 3/4 lbs	3 1/4 lbs	1 1/2 lbs
51	5 3/4 lbs	1 3/4 lbs	3 1/4 lbs	1 lb
53	4 1/2 lbs	1 3/4 lbs	2 1/4 lbs	1 1/2 lbs
55	4 lbs.	1 3/4 lbs	2 1/4 lbs	1 1/2 lbs

REF. GROUP I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T. A. NAPOLITANO

APPROVED BY [illegible]

WITNESSED BY

14

72-354-2

LABORATORY DATA SHEET

TEST: CONTACT INSERTION & REMOVAL FORCES		DATE OF TESTS: 10-26-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-81 RECEPTACLE #8		TEMP. 75°F R.H. 34%	ECL 05076-109
	LT. 3219	SPEC. L-15081-98	PARA. 6.7

TEST EQUIPMENT	CAL. DATE	DUE DATE	
DAYTRONIC STRAIN GAGE E-4011	PRIOR TO	USE	SPEC. LIMITS
ELECTRONIK-19 F-1366	9-12-72	12-7-72	TEST CONDITIONS Room Ambient
"D" LOAD CELL	PRIOR TO	USE	

CONTACT	1ST INSERTION	REMOVAL	9TH INSERTION	REMOVAL
1	3 1/4 lbs.	1 1/2 lbs.	2 lbs	1 1/2 lbs
7	2 3/4 lbs.	1 1/2 lbs.	1 1/2 lbs	3/4 lb
10	3 1/4 lbs.	2 3/4 lbs.	1 1/2 lbs	1 1/4 lbs
14	3 1/4 lbs.	2 lbs.	1 1/2 lbs	1 3/4 lbs
20	3 3/4 lbs.	1 1/2 lbs.	1 3/4 lbs	1 3/4 lbs
25	3 lbs.	1 lb.	1 1/2 lbs	1 lb
28	3 lbs.	1 1/4 lbs.	1 1/2 lbs	3/4 lb
32	3 lbs.	1 lb.	1 1/2 lbs	1 1/2 lbs
36	2 1/2 lbs.	1 1/2 lbs.	1 1/2 lbs	1 lb
40	2 3/4 lbs.	1 1/4 lbs.	1 1/4 lbs	1 1/2 lbs
45	3 1/2 lbs.	1 1/2 lbs	1 3/4 lbs	2 lbs
48	3 lbs.	1 1/2 lbs.	1 3/4 lbs	1 3/4 lbs
51	2 1/2 lbs.	1 1/2 lbs.	2 1/2 lbs	1 lb
53	3 lbs.	1 lb.	2 lbs	1 1/4 lbs
55	3 1/4 lbs.	1 1/2 lbs.	1 1/2 lb.	3/4 lb

REF. GROUP I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T. A. NAPOLITANO

APPROVED BY [signature]

WITNESSED BY

72-354-2

15

LABORATORY DATA SHEET

TEST: CONTACT INSERTION & REMOVAL FORCES			DATE OF TESTS: 10-26-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #7			TEMP. 25°C / R.H. 34%	ECL 05078-110
		LT. 3219	SPEC. L-15081-98	PARA. 6.7
TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS	
DAYTRONIC STRAIN GAGE E-4011	PRIOR TO	USE	TEST CONDITIONS ROOM AMBIENT	
ELECTRONIK-19 E-1366	9-12-72	12-9-72		
"D" LOAD CELL	PRIOR TO	USE		

CONTACT	1ST INSERTION	1ST REMOVAL	9TH INSERTION	9TH REMOVAL
1	3 1/2 lbs	2 3/4 lbs	2 3/4 lbs	1 1/4 lbs
7	3 3/4 lbs	2 lbs	2 1/2 lbs	1 1/4 lbs
10	4 1/2 lbs	2 1/2 lbs	2 1/2 lbs	1 lb
14	4 3/4 lbs	2 3/4 lbs	2 1/2 lbs	1 lb
20	4 1/4 lbs	2 lbs	2 3/4 lbs	1 1/4 lbs
25	5 lbs	1 1/2 lbs	2 1/2 lbs	3/4 lb
28	4 1/2 lbs	2 lbs	3 1/2 lbs	1 1/2 lbs
32	5 1/4 lbs	2 lbs	2 1/4 lbs	1 1/2 lbs
36	5 1/4 lbs	2 1/2 lbs	2 3/4 lbs	1 1/2 lbs
40	5 lbs	3 lbs	2 1/4 lbs	1 1/2 lbs
45	4 lbs	1 3/4 lbs	3 lbs	1 lb
48	4 1/2 lbs	2 lbs	2 3/4 lbs	1 1/2 lbs
51	5 1/2 lbs	1 3/4 lbs	2 lbs	1 1/2 lbs
53	5 3/4 lbs	1 3/4 lbs	2 1/2 lbs	1 1/4 lbs
55	5 3/4 lbs	2 lbs	2 3/4 lbs	1 1/4 lbs

REF. GROUP I

Bendix Electrical Components Division, Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO

APPROVED BY: [signature]

WITNESSED BY:

16

72-354-2

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
Contact Insertion and Removal Forces	10-26-72	12-5194
TEST SPECIMEN (S) 2-2775P-91 Receptacle #7	TEMP. 75 °F / R.H. 54%	ECL 05078-44
LT. 3219	SPEC. L-15081-98	PARA. 6.7

TEST EQUIPMENT	CAL. DATE	DUE DATE
Daytronic Strain Gage E-4011	Prior To	Use
Electronik-19 F-1366	9-12-72	12-7-72
"D" Load Cell	Prior To	Use

SPEC. LIMITS

TEST CONDITIONS Room Ambient

	1st		9th	
Contact	Insertion	Removal	Insertion	Removal
1	2 3/4 lbs.	2 lbs.	1 3/4 lbs	1 1/2 lbs
7	2 3/4 lbs.	1 1/2 lbs.	1 1/4 lbs	3 lbs
10	2 1/4 lbs	2 lbs.	1 1/2 lbs	1 1/4 lbs
14	2 3/4 lbs.	1 1/2 lbs.	1 1/2 lbs	3/4 lb
20	2 1/2 lbs	1 lb.	1 1/2 lbs.	1 lb
25	2 1/4 lbs.	3/4 lb.	1 3/4 lbs	1 1/2 lbs
28	2 1/2 lbs.	1 lb.	2 lbs	1 1/4 lbs
32	3 1/2 lbs.	1 1/2 lbs.	1 1/2 lbs	1 1/4 lbs
36	2 1/2 lbs.	2 3/4 lbs.	1 1/2 lbs	1 1/4 lbs
40	3 lbs.	1 lb.	1 1/2 lbs.	1 lb
45	3 1/4 lbs.	1 1/2 lbs.	1 1/2 lbs	1 3/4 lbs
48	2 1/2 lbs.	3/4 lb.	1 1/4 lbs.	1 1/2 lbs
51	2 1/2 lbs.	1 1/4 lbs.	1 1/2 lbs	2 lbs
53	2 1/2	1 1/4	1 1/2 lbs.	2 lbs
55	3 lbs.	1 3/4 lbs.	1 1/2 lbs.	3/4 lb.

REF. Group I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T.R. Napolitano

APPROVED BY TAA

WITNESSED BY

17

72-354-2

LABORATORY DATA SHEET

TEST: CONTACT RETENTION- REMOVABLE	DATE OF TESTS: 10-31-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #7	TEMP 74°F R.H. 84%	ECL 05078-112
L-27758-81 RECEPTACLE #7 LT. 3219	SPEC. L-15081-98	PARA. 6.6.1
TEST EQUIPMENT: INSTRON PG 1050 CAL. DATE 8-25-72 DUE DATE 2-25-73	SPEC. LIMITS: 15 lbs. .012" displacement	
	TEST CONDITIONS: MAINTENANCE Age RATE 1 lb/second	

	58-80 #7	PLUG			58-81 #7	RECEPTACLE	
CONTACT	LOAD	Displacement		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0025	inch	1	15 lbs.	.0045	inch
7	"	.003	"	7	"	.004	"
10	"	.003	"	10	"	.0045	"
14	"	.003	"	14	"	.004	"
20	"	.0025	"	20	"	.003	"
25	"	.0025	"	25	"	.003	"
28	"	.0045	"	28	"	.002	"
32	"	.0035	"	32	"	.003	"
36	"	.004	"	36	"	.004	"
40	"	.003	"	40	"	.004	"
45	"	.004	"	45	"	.0025	"
48	"	.0055	"	48	"	.0035	"
51	"	.004	"	51	"	.003	"
53	"	.003	"	53	"	.0025	"
55	"	.003	"	55	"	.003	"

REF. GROUP I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY J. A. NAPOLITANO
APPROVED BY [signature]
WITNESSED BY

72-354-2

18

LABORATORY DATA SHEET

TEST: Contact Retention - Removable			DATE OF TESTS: 10-31-72	REPORT NUMBER: 72-5194
TEST SPECIMEN (S): L-27758-80 Plug #8			TEMP 74½ / R.H. 34%	ECL 05070-113
L-27758-81 Receptacle #8		LT. 3219	SPEC. L-15081-98	PARA. 6.6.1
TEST EQUIPMENT: Instron PG 1050	CAL. DATE 8-25-72	DUE DATE 2-25-73	SPEC. LIMITS 15 lbs. .012" displacement	
			TEST CONDITIONS: Maintenance Age	
			Rate 1 lb/second	

58-80 #8 Plug				58-81 #8 Receptacle			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.003 inch		1	15 lbs.	.002 inch	
7	"	.0025	"	7	"	.003	"
10	"	.002	"	10	"	.002	"
14	"	.0025	"	14	"	.002	"
20	"	.0035	"	20	"	.002	"
25	"	.002	"	25	"	.0025	"
28	"	.002	"	28	"	.0035	"
32	"	.0025	"	32	"	.0035	"
36	"	.003	"	36	"	.004	"
40	"	.003	"	40	"	.0035	"
45	"	.002	"	45	"	.003	"
48	"	.0035	"	48	"	.003	"
51	"	.003	"	51	"	.004	"
53	"	.0035	"	53	"	.003	"
55	"	.0035	"	55	"	.003	"

REF. Group I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. Napolitano
APPROVED BY:
WITNESSED BY:

19

72-354-2

LABORATORY DATA SHEET

TEST: OPERATING FORCES	DATE OF TESTS: 11-2-72
	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUGS MATED WITH L-27758-81 RECEPTACLE	TEMP: 74°F R.H.: 34% ECL: 05078-114
LT.: 8219	SPEC.: L-15081-98 PARA.: 6.3
	SPEC. LIMITS: MAX ENG & DIS-ENGAGE. 25 IN lbs.
TEST EQUIPMENT: STURTEVANT TORQUE FIXTURE — CAL. DATE: N/A	TEST CONDITIONS: ROOM AMBIENT
STURTEVANT TORQUE WRENCH PG-1179 — CAL. DATE: 10-16-72, DUE DATE: 1-16-73	THERMAL SHOCK

AFTER THERMAL SHOCK

L-27758-80 #7 MATED WITH L-27758-81 #7

	MATING	UNMATING	
	9 IN lbs	10 IN lbs	SINGLE WAVE WASHER
*	29 IN lbs	43 IN lbs	DOUBLE WAVE WASHER

L-27758-80 #8 MATED WITH L-27758-81 #8

	MATING	UNMATING	
	9 IN lbs	12 IN lbs	SINGLE WAVE WASHER
*	30 IN lbs	45 IN lbs	DOUBLE WAVE WASHER

L-27758-80 #9 MATED WITH L-27758-81 #9

	MATING	UNMATING	
	7 IN lbs	12 IN lbs	SINGLE WAVE WASHER
*	17 IN lbs	37 IN lbs	DOUBLE WAVE WASHER

L-27758-80 #10 MATED WITH L-27758-81 #10

	MATING	UNMATING	
	7 IN lbs	8 IN lbs	SINGLE WAVE WASHER
*	25 IN lbs	40 IN lbs	DOUBLE WAVE WASHER

REF. * SECOND WAVE WASHER WAS ADDED

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: J. A. NAPOLITANO
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

20

12-5194
ECL-05078-173

SHEET 1 OF 2 SHEET(S)

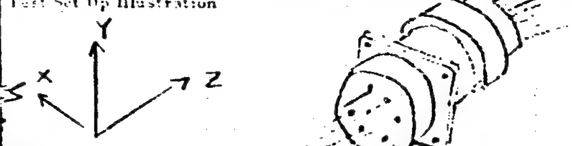
VIBRATION LOG

Test Specimen: STUB-E ARG48R TYPE, IWTS CONNECTOR - TWO MATED PAIRS, 006	Specification: L-15081-98	Para. 6.9	Vibration Log No.
Test Equipment Vibration Exciter: MB - CRO	Requested by: TRUDY NAPOLITANO		Report No.
Measuring System: ACCELEROMETER S/N YD99 & AMPLIFIER E-1444; DISCONTINUITY MONITOR F-0527; PYROTEST F-1311	Tested by: J.E. KRISKO		Approved: JJS

Date	Time	Clock Reading	Total Hours	Vibr. Axis	Velocity In./Sec.	Displ. In. D.A.	Acc. ±G	Frequency HZ	Cycle Period Minutes	Sweep Rate Degrees/Min.	Temperature °F Ambient	Temperature °F Part	Note
11-08-72	9:05Am	0170.9	-	Y	—	.060	20	10-2000-10	20	16	-85°F	—	1,3,2
11-08-72	10:06Am	0171.9	1.0	Y	—	.060	20	10-2000-10	20	16	-85°F	—	4,5
11-08-72	10:57Am	0172.7	1.0	Y	—	.060	20	10-2000-10	20	16	78°F	—	1,3,6
11-08-72	1:00Pm	0174.7	3.0	Y	—	.060	20	10-2000-10	20	16	78°F	—	4,5
11/8/72	2:00 Pm	0175.8	3.0	Y	—	.060	20	10-2000-10	20	16	347		1,3,6
11-08-72	3:00Pm	0176.8	4.0	Y	—	.060	20	10-2000-10	20	16	346°F	—	4,5
VIBRATION COMPLETED IN THIS AXIS.													
11-09-72	9:03Am	0179.3	—	X	—	.060	20	10-2000-10	20	16	-85°F	—	1,3,2
11-09-72	10:03Am	0180.3	1.0	X	—	.060	20	10-2000-10	20	16	-85°F	—	4,5
11-09-72	11:15Am	0181.5	1.0	X	—	.060	20	10-2000-10	20	16	347°F	—	1,3,6
11-09-72	12:15Pm	0182.5	2.0	X	—	.060	20	10-2000-10	20	16	347°F	—	4,5
11-09-72	1:15Pm	0183.5	2.0	X	—	.060	20	10-2000-10	20	16	78°F	—	1,3,6

Notes: (1) PARTS SOAKED AT TEMPERATURE FOR 2 1/2 HOUR PRIOR TO START OF VIBRATION. (2) VIBRATION STARTED. (3) ALL CONTACTS CONNECTED IN SERIES & MONITORED FOR DISCONTINUITIES OF 1μSec OR GREATER. (4) VIBRATION STOPPED. (5) NO DISCONTINUITIES NOTED. (6) VIBRATION RESUMED.

Test Set Up Illustration



Vibration Axis

Part Orientation

72-555

Data Sheet No.

Bendix Electrical Components Division

Sidney, N.Y. 13838

ETL 0421A-186

21

12-5194
ECL-0507B-124

SHEET 2 OF 2 SHEET(S)

VIBRATION LOG

Specification	Para.	Vibration Log No.
L-15081-98	6.9	

Requested by: TRUDY MARCANTONIO

Report No.:

Tested by: J.E. KRISKO

Approved: FJD

Test Specimen: STUB F/2648R TYPE, IWTS CONNECTOR

Test Equipment Vibration Exciter: MB-CRO

Measuring System: ACCELEROMETER S/N YD99(6) AMPLIFIER F-1444; DISCONTINUITY MONITOR F-0527; PYROTEST F-1311 C.C.

Date	Time	Clock Reading	Total Hours	Vibr. Axis	Velocity In./Sec.	Displ. In. D.A.	Acc. ±G	Frequency HZ	Cycle Period Minutes	Sweep Rate Degrees/Min.	Temperature °F Ambient	Temperature °F Part	Note
11-09-72	3:15PM	0185.5	4.0	X	—	.060	20	10-2000-10	20	16	78°F	—	4,5
VIBRATION COMPLETED IN THIS AXIS.													
11-09-72	4:29PM	0186.8	—	Z	—	.060	20	10-2000-10	20	16	-85°F	—	1,3,2
11-09-72	5:29PM	0187.8	1.0	Z	—	.060	20	10-2000-10	20	16	-85°F	—	4,5
11-09-72	6:42PM	0189.0	1.0	Z	—	.060	20	10-2000-10	20	16	347°F	—	1,3,6
11-09-72	7:43PM	0190.0	2.0	Z	—	.060	20	10-2000-10	20	16	347°F	—	4,5
11-09-72	8:27PM	0190.7	2.0	Z	—	.060	20	10-2000-10	20	16	80°F	—	1,3,6
11/9/72	10:33PM	0192.8	4.1	Z	—	.060	20	10-2000-10	20	16	76°F		5,4 FJD
VIBRATION COMPLETED IN THIS AXIS													

Note: (1) PARTS SOAKED AT TEMPERATURE FOR 2 1/2 HOUR PRIOR TO START OF VIBRATION. (2) VIBRATION STARTED. (3) ALL CONTACTS CONNECTED IN SERIES & MONITORED FOR DISCONTINUITIES OF 1.0 μSEC OR GREATER. (4) VIBRATION STOPPED. (5) NO DISCONTINUITIES NOTED. (6) VIBRATION RESUMED

Test Set Up Illustration: SEE SHEET #1

Vibration Axis

Part Orientation

Data Sheet No.

T-555

Bendix Electrical Components Division Sidney, N.Y. 13838

ETL 0421A-187

ZZ

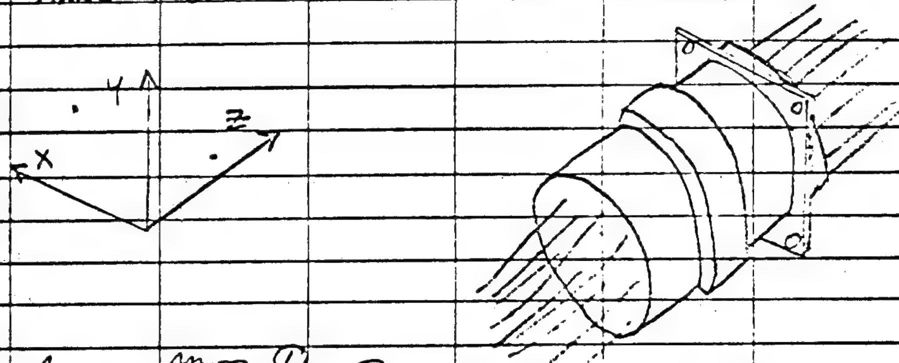
12·5194
ECL-0507B-125

SHEET 1 OF 1

Test: MECHANICAL SHOCK — 50G, 11 MILLISECOND, HALF-SINE	Ref.
Test Specimen: STUB - E/26482 TYPE, INTS CONNECTOR TWO MATED PAIRS W/ ALL CONTACTS WIRED IN SERIES	Date: 11-13-72 Spec. Para.
Test Instrument(s): HYGE SHOCK MACHINE - MODEL 3401 ACCELERATION MEASURING SYSTEM IC-578 DISCONTINUITY MONITOR F-0527	Tested By: J.E. KRISKO Approved: EJD

Test Conditions: APPLY ONE 50G SHOCK IN EACH DIRECTION OF EACH OF THREE MUTUALLY PERPENDICULAR AXES. MONITOR FOR DISCONTINUITIES OF 1 μSEC OR GREATER.

AXES OF SHOCKS — PART ORIENTATION



DATE	AXIS	APPLIED SHOCKS (1)	RESULTS
11-13-72	Z	✓	NO DISCONTINUITIES NOTED; NO MECHANICAL DETERIORATION NOTED
11-13-72	Z'	✓	NO DISCONTINUITIES OR MECHANICAL DETERIORATION NOTED
11-13-72	Y	✓	NO DISCONTINUITIES OR MECHANICAL DETERIORATION NOTED
11-13-72	Y'	✓	" " " " " "
11-13-72	X	✓	" " " " " "
11-13-72	X'	✓	" " " " " "

(1) A (✓) INDICATES AN APPLIED SHOCK OF 50G, 11 MILLISECONDS DURATION, HALF-SINE WAVEFORM.

LABORATORY DATA SHEET

ETL 0421A-188

72-354-1

Bendix Electrical Components Division
Sidney, N.Y. 13838

23

LABORATORY DATA SHEET

TEST	CONTACT RESISTANCE
TEST SPECIMEN (S)	L-27758-80 PLUG # 7 MATED WITH L-27758-81 RECEPTACLE # 7
LT.	3219
DATE OF TESTS	11-15-72
REPORT NUMBER	12-5194
TEMP.	74°F
R.H.	64%
ECL	05078-119
SPEC.	L-15087-98
PARA.	6.16
SPEC. LIMITS	60 MILLIVOLTS MAX.

TEST EQUIPMENT	CAL. DATE	DUE DATE
KEPCO POWER SUPPLY F-1375	7-5-72	7-2-73
WESTON D.C. AMMETER F-0028	6-19-72	12-27-72
Hewlett-Packard DVM F-1822	10-9-72	4-2-73
Hewlett-Packard Digital Recorder E-4622	N/A	

TEST CONDITIONS: INITIAL VIBRATION SHOCK 7.5 Amps.

CONTACT	POTENTIAL DROP	*AFTER SEVERAL MATINGS & UNMATINGS
38	54.8	
39	53.3	
*40	66.8	52.2
*55	64.8	56.1
37	48.8	
*20	61.2	59.9
21	50.5	
22	50.3	
41	49.5	
54	50.1	
*36	60.5	67 STILL FAILING
19	50.8	
8	50.2	
9	50.0	
23	51.5	
42	49.0	
53	56.2	
35	50.1	
18	50.3	
7	59.8	
*2	62.2	58.5
10	59.0	
24	50.3	
43	48.2	
*1	60.6	56.0

REF. MEASUREMENTS IN MILLIVOLTS

GROUP I

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO

APPROVED BY: [illegible signature]

WITNESSED BY:

24

72-354-2

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
CONTACT RESISTANCE	11-15-72	12-5194

TEST SPECIMEN (S)	LT.	TEMP.	R.H.	ECL
L-27758-80 PLUG #8 MATED WITH L-27758-81 RECEPTACLE #8	3219	74°F	34%	05070-RD

SPEC.	PARA.
L-15081-98	6.16

TEST EQUIPMENT	CAL. DATE	DUE DATE
KEPCO POWER SUPPLY F-1375	7-5-72	7-2-73
WESTON D.C. AMMETER F-0028	6-19-72	12-27-72
HEWLETT-PACKARD DVM F-1822	10-9-72	4-2-73
HEWLETT-PACKARD DIGITAL RECORDER E-4622	N/A	

SPEC. LIMITS: 100 MILLIVOLTS MAX.

TEST CONDITIONS: INITIAL VIBRATION SHOCK 7.5 AMPS.

CONTACT	POTENTIAL DROP
38	48.6
39	47.8
40	58.6
55	51.8
37	49.1
20	48.5
21	46.7
22	48.6
41	48.8
54	58.7
36	49.4
19	48.0
8	49.6
9	47.8
23	47.9
42	49.9
53	55.9
35	49.5
18	48.1
7	52.1
2	47.5
10	55.5
24	49.8
43	49.3
1	58.2

REF. MEASUREMENTS IN MILLIVOLTS

GROUP I

Bendix Electrical Components Division

Sidney, New York 13838

TESTED BY: J. A. NAPOLITANO

APPROVED BY: [illegible]

WITNESSED BY

25

72-354-2

LABORATORY DATA SHEET

TEST: OPERATING FORCES		DATE OF TESTS: 11-16-72	REPORT NUMBER: 72-5194
TEST SPECIMEN (S): L-27758-80 PLUGS MATED WITH L-27758-81 RECEPTACLES	LT. 3219	TEMP 74° R.H. 34%	ECL 58454-1
		SPEC. L-15081-98	PARA. 6.3

TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS
STURTEVANT TORQUE FIXTURE	N/A		25 IN LBS MAX
STURTEVANT TORQUE WRENCH FG-1179	10-16-72	1-16-73	TEST CONDITIONS: CONTACT RESISTANCE
			MEASUREMENTS IN INCH POUNDS

L-27758-80 PLUG #7 MATED WITH L-27758-81 #7

MATING	UNMATING
34 IN LBS	43 IN LBS

L-27758-80 #8 MATED WITH L-27758-81 #8

MATING	UNMATING
33 IN LBS	41 IN LBS

L-27758-80 #9 MATED WITH L-27758-81 #9

MATING	UNMATING
12 IN LBS	24 IN LBS

L-27758-80 #10 MATED WITH L-27758-81 #10

MATING	UNMATING
27 IN LBS	26 IN LBS

REF. 2 WAVE WASHERS

GRO. I & II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

26

LABORATORY DATA SHEET

TEST: Operating Forces		DATE OF TESTS: 11-21-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 Plug mated with L-27758-81 Receptacle	LT. 3E19	TEMP. 74°F R.H. 34%	ECL ~~00-49A-C~~
		SPEC. L-15381-98	PARA. 6.3
TEST EQUIPMENT	CAL. DATE / DUE DATE	SPEC. LIMITS MAX. ENG. & DIS. ENGAGE - 25 in-lbs.	
Sturtevant Torque Fixture FG-1171	N/A	TEST CONDITIONS	
Sturtevant Torque Wrench	10-16-72 / 1-16-73	Fluid Immersion	
		Measurements in inch Pounds	

Lube Oil - MIL-L-23179

L-27758-80 Plug #7 mated with L-27758-81 #7

Mating	Unmating
31 in lbs	39 in lbs

L-27758-80 #8 mated with L-27758-81 #8

Mating	Unmating
31 in lbs	36 in lbs

Hydraulic Oil MIL-H-5606

L-27758-80 #9 mated with L-27758-81 #9

Mating	Unmating
19 in lbs	22 in lbs

L-27758-80 #10 mated with L-27758-81 #10

Mating	Unmating
27 in lbs	33 in lbs

REF. 2 WAVE WASHERS

GRP. I & II

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY: F. D. [illegible]
APPROVED BY: [illegible]
WITNESSED BY

72-354-2

27

LABORATORY DATA SHEET

TEST: INSULATION RESISTANCE (ELEV. TEMP)		DATE OF TESTS: 11-3-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG # 9 MATED WITH L-27758-81 RECEPTACLE # 9	LT. 3219	TEMP.: ROOM AMBIENT; R.H.	ECL: 05078-115
		SPEC.: L-15081-98	PARA.: 6.13
TEST EQUIPMENT		SPEC. LIMITS: 200 MEGOHMS MIN.	

TEST EQUIPMENT		CAL. DATE	DUE DATE
GENERAL RADIO MEGOHM BRIDGE	F-1514	8-29-72	8-27-73
SWITCHING FIXTURE	#2	PRIOR TO	USE

TEST CONDITIONS: ROOM AMBIENT THERMAL SHOCK

MEASUREMENTS IN MEGOHMS

CONTACT	INSULATION RESISTANCE		CONTACT	INSULATION RESISTANCE		CONTACT	INSULATION RESISTANCE
1	9×10^3		26	6×10^3		51	10×10^3
2	6×10^3		27	6×10^3		52	9×10^3
3	6×10^3		28	6×10^3		53	8.5×10^3
4	6.5×10^3		29	6.5×10^3		54	7.5×10^3
5	7.6×10^3		30	7.5×10^3		55	9×10^3
6	7.5×10^3		31	6.5×10^3			
7	8×10^3		32	6.7×10^3			
8	8×10^3		33	7×10^3			
9	7×10^3		34	7×10^3			
10	6×10^3		35	7×10^3			
11	6.5×10^3		36	10×10^3			
12	7.5×10^3		37	10×10^3			
13	5.5×10^3		38	6×10^3			
14	5×10^3		39	8×10^3			
15	6.3×10^3		40	8×10^3			
16	7.5×10^3		41	7.5×10^3			
17	7×10^3		42	7×10^3			
18	6×10^3		43	6×10^3			
19	7.5×10^3		44	7×10^3			
20	9×10^3		45	7.5×10^3			
21	8×10^3		46	7×10^3			
22	7×10^3		47	8×10^3			
23	6×10^3		48	6.5×10^3			
24	7×10^3		49	8.5×10^3			
25	5×10^3		50	9×10^3			

REF GROUP II
MEASUREMENTS AFTER 30 MINUTES @ 347°F

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. NAPOLITANO
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

28

LABORATORY · DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
INSULATION RESISTANCE (ELEV. TEMP)	11-8-72	12-5194

TEST SPECIMEN (S)	LT.	TEMP	R.H.	ECL
L-Z7758-80 PLUG #10 MATED WITH L-Z7758-81 RECEPTACLE #10	3219	Room Ambient		EL05070-116

SPEC.	PARA.
L-15081-98	6.13

TEST EQUIPMENT	CAL. DATE	DUE DATE
GENERAL RADIO MEGOHM BRIDGE E1514	8-29-72	8-27-73
SWITCHING FIXTURE #2	PRIOR TO USE	

SPEC. LIMITS: 200 MEGOHMS MIN.

TEST CONDITIONS: ROOM AMBIENT THERMAL SHOCK

MEASUREMENTS IN MEGOHMS

CONTACT	INSULATION RESISTANCE		CONTACT	INSULATION RESISTANCE		CONTACT	INSULATION RESISTANCE
1	10×10^3		26	11×10^3		51	9×10^3
2	9.3×10^3		27	10×10^3		52	12×10^3
3	13×10^3		28	9.5×10^3		53	9.5×10^3
4	16×10^3		29	12×10^3		54	10.2×10^3
5	9×10^3		30	13×10^3		55	12×10^3
6	11×10^3		31	13×10^3			
7	10×10^3		32	11.8×10^3			
8	15×10^3		33	12×10^3			
9	14×10^3		34	10×10^3			
10	11×10^3		35	12×10^3			
11	13×10^3		36	15×10^3			
12	10×10^3		37	12×10^3			
13	11×10^3		38	15×10^3			
14	9×10^3		39	12×10^3			
15	9.5×10^3		40	12×10^3			
16	13×10^3		41	13×10^3			
17	10×10^3		42	10×10^3			
18	11×10^3		43	14×10^3			
19	9.5×10^3		44	9×10^3			
20	10×10^3		45	16×10^3			
21	10×10^3		46	7×10^3			
22	15×10^3		47	9×10^3			
23	12×10^3		48	9.5×10^3			
24	9×10^3		49	9.5×10^3			
25	12×10^3		50	10×10^3			

REF. GROUP II MEASUREMENTS AFTER 30 MINUTES @ 347°F

Bendix Electrical Components Division Sidney New York 13838

TESTED BY: J. A. NAPOLITANO

APPROVED BY: [illegible]

WITNESSED BY

72-354-2

217

LABORATORY DATA SHEET

TEST: AIR LEAKAGE		DATE OF TESTS: 11/9/72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG		TEMP. / R.H.	ECL: 06078-118
L-27758-81 RECEPTACLE	LT. B219	SPEC.: L-N081-98	PARA.: 6.14

TEST EQUIPMENT		CAL/DATE	DUE DATE
Cold Box	F-0361	1/6/71	1/3/73
Pressure GAGE	PG-1222	6/16/72	12/16/72
Graduated Beaker		N/A	

SPEC. LIMITS: MAX LEAKAGE 1 in³/Hour

TEST CONDITIONS: INSULATION RESISTANCE (ELEV. TEMP) THERMAL SHOCK −85°F 30 PSI

CONNECTOR		LEAKAGE RATE
PLUG	# 9	No leakage
PLUG	# 10	No leakage
RECEPTACLE	# 9	182 in^3/hr
RECEPTACLE	# 10	No Leakage

REF: Grp II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: [signature]
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

30

LABORATORY DATA SHEET

TEST: CONTACT RESISTANCE		DATE OF TESTS: 11-15-72	REPORT NUMBER: 72-5194
TEST SPECIMEN (S): L-27758-80 PLUG # 9 MATED WITH L-27758-81 RECEPTACLE #9	LT. 3219	TEMP. 71 °F R.H. 34%	ECL ENG 05073-122
		SPEC. L-15081-98	PARA. 6.16

TEST EQUIPMENT	CAL. DATE	DUE DATE	
KEPCO POWER SUPPLY D.C. AMMETER F-132	7-5-72	7-2-73	SPEC. LIMITS: 100 MILLIVOLTS MAX.
WESTON DC AMMETER F-0028	6-19-72	12-27-72	TEST CONDITIONS: INITIAL AIR LEAKAGE
HEWLETT-PACKARD DVM F-1822	10-9-72	4-2-73	
HEWLETT-PACKARD DIGITAL RECORDER E-4622	N/A		7.5 AMPS.

CONTACT	POTENTIAL DROP	AFTER SEVERAL MATINGS: / UN MATINGS:
38	50.4	
39	57.3	
40	58.2	
* 55	170.0	59.8
37	49.5	
* 20	110.0	96.5
21	47.8	
22	48.6	
41	50.3	
54	47.4	
* 36	84.7	51.2
19	50.2	
8	49.1	
9	48.6	
23	48.7	
42	48.8	
* 53	109.0	54.1
35	48.1	
18	49.0	
* 7	93.8	61.5
2	49.9	
* 10	73.0	57.9
24	49.4	
43	49.3	
1	59.0	

REF. MEASUREMENTS IN MILLIVOLTS

GROUP II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. R. NAPOLITANO
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

31

LABORATORY DATA SHEET

TEST	CONTACT RESISTANCE
TEST SPECIMEN (S)	L-Z7758-80 PLUG #10 MATED WITH L-Z7758-81 RECEPTACLE #10
LT.	RZ19
DATE OF TESTS	11-15-72
REPORT NUMBER	12-5194
TEMP.	74°F
R.H.	34%
ECL / EPL	00070-102
SPEC.	L-15081-98
PARA.	4.14
SPEC. LIMITS	60 MILLIVOLTS MAX
TEST CONDITIONS	INITIAL AIR LEAKAGE 7.5 AMPS

TEST EQUIPMENT		CAL. DATE	DUE DATE
KEPCO POWER SUPPLY	E-1375	7-5-72	7-2-73
WESTON DC AMMETER	E-0028	6-19-72	12-27-72
HEWLETT-PACKARD DVM	E-1822	10-9-72	4-2-73
HEWLETT-PACKARD DIGITAL RECORDER	E-4622	N/A	

CONTACT	POTENTIAL DROP		
38	48.6		
39	51.9		
40	49.4		
55	50.8		
37	49.5		
20	51.6		
21	52.4		
22	48.5		
41	50.9		
54	49.3		
36	50.9		
19	47.6		
8	48.2		
9	48.6		
23	46.9		
42	58.0		
53	52.0		
35	50.6		
18	48.8		
* 7	61.2	55.0	* AFTER MATING & UN-MATING TWICE.
2	48.9		
10	51.7		
24	49.0		
43	50.0		
1	54.1		

REF. MEASUREMENTS IN MILLIVOLTS

GROUP II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY J. A. NAPOLITANO

APPROVED BY [signature]

WITNESSED BY

72-354-2

3Z.

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
CONTACT RETENTION - REMOVABLE	11-17-72	12-5194
TEST SPECIMEN (S) L-27758-80 PLUG #9	TEMP. 74°F R.H. 34%	ECL ~~05952-5~~ ~~00078~~ 124
L-27758-81 RECEPTACLE #9 — LT. 3219	SPEC. L-15081-98	PARA. 6.6.1

TEST EQUIPMENT		CAL. DATE	DUE DATE	SPEC. LIMITS
INSTRON	PG105A	9-25-72	2-25-75	15 lbs. .012" displacement

TEST CONDITIONS
AIR LEAKAGE
RATE 1lb/SECOND

58-80 #9 PLUG				58-81 #9 RECEPTACLE			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0085	INCH	1	15 lbs.	.0065	INCH
7	"	.008	"	7	"	.004	"
10	"	.007	"	10	"	.0045	"
14	"	.007	"	14	"	.0055	"
20	"	.0055	"	20	"	.004	"
25	"	.004	"	25	"	.006	"
28	"	.005	"	28	"	.007	"
32	"	.0055	"	32	"	.005	"
36	"	.0055	"	36	"	.005	"
40	"	.003	"	40	"	.0045	"
45	"	.005	"	45	"	.0075	"
48	"	.0035	"	48	"	.006	"
51	"	.0035	"	51	"	.0055	"
53	"	.0045	"	53	"	.0045	"
55	"	.0045	"	55	"	.004	"

REF. GROUP II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY T. A. Napolitano
APPROVED BY AUA
WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - REMOVABLE		DATE OF TESTS: 11-17-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG # 10		TEMP. 74°F / R.H. 34%	ECL
L-27758-81 RECEPTACLE # 10	LT. 3Z19	SPEC. L-15081-98	PARA. 6.6.1
TEST EQUIPMENT: INSTRON PG 1050	CAL. DATE 8-25-72 / DUE DATE 2-25-73	SPEC. LIMITS 15 lbs. .012" displacement	
		TEST CONDITIONS: AIR LEAKAGE RATE 1 lb/SECOND	

	58-80 #10 PLUG				58-81 #10 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.003	inch	1	15 lbs.	.0035	inch
7	"	.0025	"	7	"	.003	"
10	"	.004	"	10	"	.0035	"
14	"	.0035	"	14	"	.004	"
20	"	.003	"	20	"	.0035	"
25	"	.003	"	25	"	.0035	"
28	"	.003	"	28	"	.006	"
32	"	.0035	"	32	"	.0035	"
36	"	.0025	"	36	"	.003	"
40	"	.003	"	40	"	.006	"
45	"	.0035	"	45	"	.0045	"
48	"	.004	"	48	"	.006	"
51	"	.003	"	51	"	.004	"
53	"	.003	"	53	"	.003	"
55	"	.003	"	55	"	.0045	"

REF. Group II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY

72-354-2

34

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - FIXED		DATE OF TESTS: 11-17-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #9		TEMP: 74° R.H.: 34%	ECL: [illegible]
L-27758-81 RECEPTACLE #9	LT. 3219	SPEC.: L-15081-98	PARA.: 6.6.2
TEST EQUIPMENT: INSTRON PG 1050	CAL. DATE: 2-25-72 DUE DATE: 2-25-73	SPEC. LIMITS: 15 lbs. .012" displacement	
		TEST CONDITIONS: AIR LEAKAGE RATE 1lb/SECOND	

58-80 #9 PLUG				58-81 #9 RECEPTACLE			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.005	INCH	1	15 lbs.	.0025	INCH
7	"	.0025	"	7	"	.003	"
10	"	.003	"	10	"	.0035	"
14	"	.0035	"	14	"	.0025	"
20	"	.0025	"	20	"	.003	"
25	"	.003	"	25	"	.0025	"
28	"	.003	"	28	"	.0025	"
32	"	.003	"	32	"	.0025	"
36	"	.003	"	36	"	.003	"
40	"	.0035	"	40	"	.0035	"
45	"	.0035	"	45	"	.003	"
48	"	.0045	"	48	"	.0025	"
51	"	.004	"	51	"	.0025	"
53	"	.004	"	53	"	.0025	"
55	"	.003	"	55	"	.0035	"

REF. GROUP II

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

35

LABORATORY DATA SHEET

TEST	CONTACT RETENTION - FIXED
TEST SPECIMEN (S)	L-27758-80 PLUG # 10
	L-27758-81 RECEPTACLE # 10
LT.	3219
TEST EQUIPMENT	INSTRON PG 1050
CAL. DATE	8-25-72
DUE DATE	2-25-73
DATE OF TESTS	11-17-72
REPORT NUMBER	12-5194
TEMP.	74°F
R.H.	34%
ECL	0502-0-127
SPEC.	L-15081-98
PARA.	6.6.2
SPEC. LIMITS	15 lbs. .012" displacement
TEST CONDITIONS	AIR LEAKAGE RATE 1 lb/SECOND

	58-80 #10 PLUG				58-81 #10 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.0025	INCH	1	15 lbs.	.002	INCH
7	"	.004	"	7	"	.002	"
10	"	.0025	"	10	"	.002	"
14	"	.0025	"	14	"	.002	"
20	"	.0035	"	20	"	.002	"
25	"	.0025	"	25	"	.0025	"
28	"	.0025	"	28	"	.0025	"
32	"	.002	"	32	"	.0025	"
36	"	.002	"	36	"	.002	"
40	"	.002	"	40	"	.003	"
45	"	.003	"	45	"	.003	"
48	"	.0025	"	48	"	.003	"
51	"	.0025	"	51	"	.0025	"
53	"	.003	"	53	"	.002	"
55	"	.0045	"	55	"	.002	"

REF. Group II	Bendix Electrical Components Division Sidney, New York 13838	TESTED BY T. A. Napolitano APPROVED BY [illegible] WITNESSED BY

72-354-2

36

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
OPERATING FORCES	11-3-72	12-5194
TEST SPECIMEN (S) L-27758-80 PLUG #11 & 12 MATED WITH RECEPTACLE - L-27758-81 #11 & 12 LT. 3219	TEMP. 74°F R.H. 34%	ECL 05070-117
	SPEC. L-15081-98	PARA. 6.3

TEST EQUIPMENT	CAL. DATE	DUE DATE	
STURTEVANT TORQUE FIXTURE	N/A		SPEC. LIMITS MAX ENG & DISENGAGE 25 IN LBS.
STURTEVANT TORQUE WRENCH P2-1179	10-16-72	1-16-73	TEST CONDITIONS ROOM AMBIENT DURABILITY

L-27758-80 #11 MATED WITH L-27758-81 #11

	MATING	UNMATING	
	5 IN LBS	12 IN LBS	SINGLE WAVE WASHER
*	26 IN LBS	42 IN LBS	DOUBLE WAVE WASHER

L-27758-80 #12 MATED WITH L-27758-81 #12

	MATING	UNMATING	
	6 IN LBS	12 IN LBS	SINGLE WAVE WASHER
*	29 IN LBS	40 IN LBS	DOUBLE WAVE WASHER

REF. GROUP III
* SECOND WAVE WASHER ADDED

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY J. A. NAPOLITANO
APPROVED BY [signature]
WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST: INSULATION RESISTANCE - AT TEMP.	DATE OF TESTS: 12-18-72
	REPORT NUMBER: 12-5194
	TEMP. / R.H.
	ECL: 0545A-7
TEST SPECIMEN (S): L-27758-80 PLUG #11 MATED WITH L-27758-81 RECEPT. #11	LT. 3219
	SPEC. L-15081-98
	PARA. 6.19
	SPEC. LIMITS: 200 MEGOHMS. MIN.

TEST EQUIPMENT	CAL. DATE	DUE DATE
General Radio megohm Bridge F-0555	6-6-72	6-4-73
Switching FIXTURE #9	N/A	

TEST CONDITIONS: TEMPERATURE LIFE 1000 HRS @ 175°C

TEST POTENTIAL 500VDC

CONTACT	INSULATION RESISTANCE	
1	3×10^5	MEGOHMS
2	3×10^5	"
3	5×10^5	"
4	4.5×10^5	"
5	7×10^5	"
6	7×10^5	"
7	5×10^5	"
8	3×10^5	"
9	7×10^5	"
10	4×10^5	"
11	4×10^5	"
12	3.5×10^5	"
38	3×10^5	"
40	3×10^5	"
50	7×10^5	"
52	4×10^5	"
53	3×10^5	"
55	3×10^5	"

REF. GRP. III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. C. Napolitano

APPROVED BY: [illegible]

WITNESSED BY

72-354-2

30

LABORATORY DATA SHEET

TEST: INSULATION RESISTANCE - AT TEMP.	DATE OF TESTS: 12-18-72
REPORT NUMBER: 12-5194	
TEST SPECIMEN (S): L-27758-80 PLUG #12 mated with L-27758-81 RECEPT. #12	LT. 3219
TEMP.	R.H.
ECL: 0545A-8	
SPEC.: L-1508198	PARA.: 6.19
TEST EQUIPMENT: General Radio megohm Bridge F-0555	CAL. DATE: 6-6-72 / DUE DATE: 6-4-73
Switching Fixture #9	CAL. DATE: N/A
SPEC. LIMITS: 200 megohms min.	
TEST CONDITIONS: Temperature Life 1000 Hrs. @ 175°C. Test Potential 500 VDC	

CONTACT	INSULATION RESISTANCE	MEGOHMS
1	4.5×10^5	"
2	4×10^5	"
3	4×10^5	"
4	3.5×10^5	"
5	4.5×10^5	"
6	3×10^5	"
7	3.5×10^5	"
8	4×10^5	"
9	4×10^5	"
10	4×10^5	"
11	4×10^5	"
12	4×10^5	"
38	5×10^5	"
40	6×10^5	"
50	4.5×10^5	"
52	3×10^5	"
53	1.7×10^5	"
55	6×10^5	"

REF Grp. III

Bendix Electrical Components Division

Sidney, New York 13838

TESTED BY: J. A. Napolitano

APPROVED BY: [signature]

WITNESSED BY

72-354-2

39

LABORATORY DATA SHEET

TEST: OPERATING FORCES		DATE OF TESTS: 12-18-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-Z7758-80 PLUG # mated with L-Z7758-81 RECEPTACLE	LT. 3X19	TEMP. 74 °F R.H. 34%	ECL 05450-9
		SPEC. L-15681-98	PARA. 6.3
TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS: 25 IN LBS. MAX.
STURTEVANT TORQUE FIXTURE FG-1192	N/A		TEST CONDITIONS
STURTEVANT TORQUE WRENCH	10-16-72	1-16-73	TEMPERATURE LAB
			MEASUREMENTS IN INCH POUNDS

L-Z7758-80 PLUG #11 MATED WITH L-Z7758-81 #11

MATING	UNMATING
74 IN LBS.	62 IN LBS.

L-Z7758-80 #12 MATED WITH L-Z7758-81 #12

MATING	UNMATING
87 IN LBS.	80 IN LBS.

REF. GROUP III

DOUBLE WAVE WASHER

Bendix Electrical Components Division

Sidney, New York 13838

TESTED BY: Z. A. Napolitano

APPROVED BY: [illegible]

WITNESSED BY

72-354-2

40

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - REMOVABLE			DATE OF TESTS: 12-19-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #11			TEMP. 74° / R.H. 34%	ECL 05458-11
L-27758-81 RECEPTACLE #11	LT. 3219		SPEC. L-15081-98	PARA. 6.6.1
TEST EQUIPMENT: INSTRON PG 1050	CAL. DATE 8-25-72	DUE DATE 2-25-73	SPEC. LIMITS: 15 lbs. .012" displacement	
			TEST CONDITIONS: TEMPERATURE LIFE RATE 1lb/ second	

	58-80 #11 PLUG				58-81 #11 RECEPTACLE		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.003	INCH	1	15 lbs.	.0025	INCH
7	"	.0025	"	7	"	.002	"
10	"	.002	"	10	"	.002	"
14	"	.0025	"	14	"	.0025	"
20	"	.003	"	20	"	.0025	"
25	"	.0025	"	25	"	.002	"
28	"	.002	"	28	"	.002	"
32	"	.003	"	32	"	.002	"
36	"	.0035	"	36	"	.0035	"
40	"	.003	"	40	"	.0025	"
45	"	.002	"	45	"	.0025	"
48	"	.0035	"	48	"	.0035	"
51	"	.004	"	51	"	.0025	"
53	"	.004	"	53	"	.003	"
55	"	.004	"	55	"	.0025	"

REF. Group III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY

72-354-2

4/1

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - REMOVABLE	DATE OF TESTS: 12-19-72
	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-27758-80 PLUG #12	TEMP: 74°F
	R.H.: 34%
	ECL: 05459-12
L-27758-81 RECEPTACLE #12	LT.: 3219
	SPEC.: L-25081-98
	PARA.: 6.6.1
TEST EQUIPMENT: INSTRON PG-1050	CAL. DATE: 8-25-72
	DUE DATE: 2-25-73
	SPEC. LIMITS: 15 lbs. .012" displacement
	TEST CONDITIONS: TEMPERATURE LIFE; RATE 1 lb/ SECOND

58-80 #12 PLUG				58-81 #12 RECEPTACLE			
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs	.003	INCH	1	15 lbs	.003	INCH
7	"	.0025	"	7	"	.002	"
10	"	.003	"	10	"	.003	"
14	"	.0035	"	14	"	.0035	"
20	"	.002	"	20	"	.003	"
25	"	.0035	"	25	"	.0025	"
28	"	.005	"	28	"	.002	"
32	"	.003	"	32	"	.004	"
36	"	.003	"	36	"	.0045	"
40	"	.003	"	40	"	.0045	"
45	"	.005	"	45	"	.002	"
48	"	.005	"	48	"	.003	"
51	"	.0025	"	51	"	.0055	"
53	"	.0025	"	53	"	.003	"
55	"	.002	"	55	"	.007	"

REF: Grp III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: Z.A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

1/2

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - FIXED			DATE OF TESTS: 12-19-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-22758-80 PLUG #11			TEMP. 74°F R.H. 34%	ECL 0545A-13
L-22758-81 RECEPTACLE #11		LT. 3219	SPEC. L-150 81-98	PARA. 6.6.2
TEST EQUIPMENT: INSTRON PC-1050	CAL. DATE 8-25-72	DUE DATE 2-25-75	SPEC. LIMITS: 15 lbs. .012" displacement	
			TEST CONDITIONS: TEMPERATURE LIFE	
			RATE 1lb/second	

	58-80	#11 PLUG			58-81	#11 RECEPTACLE	
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15 lbs.	.003	INCH	1	15 lbs.	.0015	INCH
7	"	.003	"	7	"	.002	"
10	"	.0035	"	10	"	.0015	"
14	"	.0035	"	14	"	.002	"
20	"	.0035	"	20	"	.002	"
25	"	.0035	"	25	"	.002	"
28	"	.003	"	28	"	.002	"
32	"	.0035	"	32	"	.002	"
36	"	.004	"	36	"	.002	"
40	"	.004	"	40	"	.003	"
45	"	.004	"	45	"	.002	"
48	"	.004	"	48	"	.002	"
51	"	.004	"	51	"	.002	"
53	"	.0035	"	53	"	.002	"
55	"	.0045	"	55	"	.002	"

REF. Grp. III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T.A. Napolitano
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

43

LABORATORY DATA SHEET

TEST: CONTACT RETENTION - FIXED		DATE OF TESTS: 12-19-72	REPORT NUMBER: 12.5194
TEST SPECIMEN (S): L-27758-80 Plug #12		TEMP. 74°F / R.H. 34%	ECL 05452-14
L-27758-81 Receptacle #12	LT. 3219	SPEC. L-15081-98	PARA. 6.6.2
TEST EQUIPMENT: INSTRON PG-1050	CAL. DATE 8-25-72 / DUE DATE 2-25-73	SPEC. LIMITS: 15lbs .012" displacement	
		TEST CONDITIONS: Temperature Life Rate 1lb/second	

	58-80 #12 Plug				58-81 #12 Receptacle		
CONTACT	LOAD	DISPLACEMENT		CONTACT	LOAD	DISPLACEMENT	
1	15lbs.	.0025	inch	1	15lbs.	.002	inch
7	"	.002	"	7	"	.0025	"
10	"	.002	"	10	"	.0015	"
14	"	.003	"	14	"	.0025	"
20	"	.0025	"	20	"	.0025	"
25	"	.002	"	25	"	.002	"
28	"	.003	"	28	"	.0025	"
32	"	.003	"	32	"	.002	"
36	"	.002	"	36	"	.003	"
40	"	.0025	"	40	"	.0025	"
45	"	.0025	"	45	"	.0015	"
48	"	.0025	"	48	"	.0025	"
51	"	.003	"	51	"	.003	"
53	"	.0025	"	53	"	.003	"
55	"	.0025	"	55	"	.0035	"

REF. Group III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: T. A. Napolitano
APPROVED BY: [illegible]
WITNESSED BY:

72-354-2

44

LABORATORY DATA SHEET

TEST: CONTACT RESISTANCE	DATE OF TESTS: 12-20-72	REPORT NUMBER: 12-5194
TEST SPECIMEN (S): L-Z7758-80 PLUG #11 MATED WITH L-Z7758-81 RECEPTACLE #11 — LT. 3Z19	TEMP. 74°F — R.H. 54%	ECL. EM 05850-16
	SPEC. L-15081-98	PARA. 6.16

TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS: 70 MILLIVOLTS MAX
KEPCO POWER Supply (AC) F-1375	7-5-72	7-2-73	TEST CONDITIONS: AFTER TEMPERATURE LIFE
WESTON DC AMMETER F-0028	12-20-72	6-13-73	
Hewlett-Packard digital voltmeter F-1822	10-9-72	4-2-73	
Hewlett-Packard digital recorder E-4627	N/A		7.5 AMPS

CONTACT	POTENTIAL DROP	
38	52.5	
39	49.9	
* 40	83.6	EXCEEDS SPEC LIMIT
65	58.6	
37	50.3	
20	64.5	
21	51.7	
22	49.6	
41	66.8	
54	49.2	
36	53.4	
19	68.9	
8	52.2	
9	49.2	
23	48.6	
42	49.5	
53	49.9	
35	52.1	
18	52.8	
* 7	109.8	EXCEEDS SPEC LIMIT
2	47.3	
10	66.3	
24	53.4	
43	52.2	
* 1	76.9	intermittent circuit

REF. MEASUREMENTS IN MILLIVOLTS

GROUP III

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY: T. R. WAPOLITAWA
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

45

LABORATORY DATA SHEET

TEST	CONTACT RESISTANCE
TEST SPECIMEN (S)	L-Z7758-80 PLUG #12 MATED WITH L-Z7758-81 RECEPTACLE #12
LT.	3219
DATE OF TESTS	12-20-72
REPORT NUMBER	12-5194
TEMP.	74°F
R.H.	34%
ECL	05938-17
SPEC.	L-15081-98
PARA.	6.16
SPEC. LIMITS	70 MILLIVOLTS MAX
TEST CONDITIONS	AFTER TEMPERATURE LIFE 7.5 AMPS.

TEST EQUIPMENT		CAL. DATE	DUE DATE
KEPCO D.C. Power Supply	F-1375	7-5-72	7-2-73
WESTON D.C. AMMETER	F-0028	12-20-72	6-13-73
HEWLETT-PACKARD DVM	F-1822	10-9-72	4-2-73
HEWLETT-Packard Digital RECORDER	E-4622	N/A	

CONTACT	POTENTIAL DROP
38	54.6
39	48.9
40	63.1
55	67.3
37	51.9
20	67.1
21	58.2
22	51.4
41	50.2
54	48.9
36	57.6
19	50.4
8	50.4
9	49.8
23	50.9
42	49.0
53	60.0
35	54.4
18	50.3
7	52.3
2	48.4
10	50.8
24	50.6
43	50.5
1	67.2

REF. MEASUREMENTS IN MILLIVOLTS

GROUP III

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: J. A. NAPOLITANO

APPROVED BY: [illegible]

WITNESSED BY:

72-354-2

46

APPENDIX B

BENDIX TEST PROCEDURE

L-15031-98

L-15081-98

PRE-PRODUCTION TESTING OF

INTEGRATED WIRE TERMINATION

SYSTEM ELECTRICAL CONNECTORS

FOR USAECOM

THE BENDIX CORPORATION
ELECTRICAL COMPONENTS DIVISION
SIDNEY, NEW YORK

1.0 **Scope**

The purpose of this test procedure is to establish the samples and test methods to be used in pre-production testing of MIL-C-81511B and "Stub-E" (Ordnance Document 11176551) type electrical connectors which are modified for inclusion of the Integrated Wire Termination System.

The test methods and limits contained herein were chosen as being applicable for these connector designs. They are derived essentially from the two documents referenced above.

2.0 **Test Agency**

All tests herein described will be performed at and by the Engineering Laboratory, Electrical Components Division, The Bendix Corporation, Sidney, New York 13838.

3.0 **Standard Test Conditions**

Unless otherwise specified, tests and examinations specified by this procedure will be conducted under any combination within the ranges below:

Temperature	68°F to 95°F
Relative Humidity	10% to 80%
Barometric Pressure	24" to 31" Hg

4.0 **Test Samples**

A total of 12 mating connectors will be required for this test program. They are identified as follows:

Test Sample No.	Type	Bendix Part No.	Shell Config.	Retention
1,2,3,4,5,6	81511	L-27758-24	Plug	Metallic
"	"	L-27758-25	Receptacle	"
7,8,9,10,11,12	Stub"E"	L-27758-104	Plug	Dielectric
"	"	L-27758-105	Receptacle	"

The MIL-C-81511 connectors have 85 Size 22D contacts, (18-85 arrangement), and the Stub "E" connectors have 55 Size 20 contacts (22-55 arrangement).

5.0 **Test Sequence**

The connectors shall be subjected to the tests in the following sequence in the order listed:

Test	Para.	Test Samples 1,2,7,8	3,4,9,10	5,6,11,12
Examination of Product	6.1	X	X	X
Wire & Prepare	6.2	X	X	X
Operating Torques	6.3	X	X	X
Insulation Resistance	6.4	X	X	X
Dielectric Withstanding Voltage	6.5	X	X	X
Contact Retention (Remov. & Fixed)	6.6	X	X	X
Maintenance Age	6.7	X		
Contact Retention (Remov. Only)	6.6.1	X		
Thermal Shock	6.8	X	X	
Vibration	6.9	X		
Shock	6.10	X		
Moisture Resistance	6.11	X		
Dielectric Withstanding Voltage (Alt.)	6.12		X	
Insulation Resistance (Elev. Temp.)	6.13		X	
Air Leakage	6.14		X	
Water Immersion	6.15		X	
Contact Resistance	6.16	X	X	
Salt Spray	6.17		X	
Operating Torques	6.3	X	X	
Contact Resistance	6.16		X	
Contact Retention (Remov. & Fixed)	6.6		X	
Durability	6.18			X
Temperature Life	6.19			X
Fluid Immersion - Lube Oil	6.20.1	X		
Fluid Immersion - Hydr. Oil	6.20.2		X	
Operating Torques	6.3	X	X	X
Insert Retention	6.21	X		
Dielectric Withstanding Voltage	6.5			X
Contact Retention	6.6			X
Insulation Resistance	6.4			X
Dielectric Withstanding Voltage (Alt.)	6.12			X
Contact Resistance	6.16			X
Final Examination of Product	6.22	X	X	X

6.0 Test Descriptions

Following are the descriptions of how each individual test will be performed.

6.1 Examination of Product

The individual connectors will be inspected for conformance to the applicable Bendix assembly drawings and for general quality of workmanship.

6.2 Wire and Prepare

Each connector half shall be permanently marked (etched) with its own test number, (ref. Para. 4.0). Each removable socket termination shall be crimped to a three foot length of teflon insulated wire and installed into the insert cavities. The Stub "E" connectors shall all be wired with nominal diameter 20 gage wire. Samples 1, 3 & 5 (81511) shall be wired with minimum diameter wire while 2,4 & 6 shall be wired with maximum diameter wire.

6.3 Operating Torques

Each plug shall be coupled to its counterpart receptacle and uncoupled at a slow uniform rate. The peak torques shall be measured using a torque wrench and appropriate fixturing. The torques shall be within the following limits:

Connector	Torque - Lb. In. Max. Eng. & Disengaging	Minimum Disengaging
MIL-C-81511	28	4
Stub "E"	25	-

6.4 Insulation Resistance

The insulation resistance of the mated connectors shall be measured between each of 12 contacts and all other contacts and shell tied electrically in common. Six of the contacts shall be adjacent to the shell. The measurements shall be made at a test potential of 500 VDC ± 10% and electrification time shall not exceed 2 minutes. All values shall be greater than 5,000 megohms.

6.5 Dielectric Withstanding Voltage

The mated connectors shall have an AC potential applied between each contact and all other contacts and shell tied electrically in common for a period of 2 seconds per circuit. Leakage current shall not exceed 1 ma. The applied voltage shall be as follows:

Connector	Potential-A.C. RMS
81511	1300
Stub "E"	1500

6.6 Contact Retention

6.6.1 Removable Contacts

Fifteen contacts shall be removed and replaced with a specially made test contact for contact retention. This contact shall incorporate its own retention member release sleeve and have a "tail" long enough to allow a load to be applied. With this fixture in each contact cavity to be tested, a load will be applied at a rate of approximately 1 lb/sec. and monitored for a period of 5-10 seconds without being displaced by more than 0.012 in. while under load. The loads to be applied are:

Connector	Load-Lbs.
81511	10
Stub "E"	15

6.6.2 Fixed Contacts

Fifteen fixed contacts in each connector half shall have a load (see 6.6.1) applied to their mating ends at a rate of approximately 1 lb/sec. and monitored for a period of 5 to 10 seconds without being displaced by more than 0.012 in. while under load.

6.7 Maintenance Age

Each removable contact shall be removed from and reinserted into its individual insert cavity using appropriate insertion and removal tools. The fifteen contacts already subjected to contact retention shall be removed and reinserted an additional 9 times. The forces to insert and remove these contacts shall be measured on the 1st and 9th cycles.

6.8 Thermal Shock

The unmated connectors shall be subjected to 5 continuous cycles of temperature shock. Each cycle shall consist of 1/2 hour at $-65\ {}^{+0°}_{-5°}$ C followed by 1/2 hour at $+175\ {}^{+3°}_{-0°}$ C with no more than 5 minutes elapsing between temperature extremes. There shall be no damage detrimental to the operation of the connector after being subjected to this conditioning.

6.9 Vibration

The mated connectors shall be rigidly mounted on a vibration exciter using a suitable vibration test fixture and their normal mounting means. A minimum of 8 inches of wire shall be unsupported on both ends of the connector. The connector shall be subjected to a vibration level of either 0.06 inch d.a. or 20G peak, whichever is less. The vibration frequency shall be varied logarithmically between 10 and 2000 Hz and back to 10 Hz in a period of 20 minutes. The vibration sweep shall be applied 12 times (4 hours) in each of 3 mutually perpendicular axes. Each 4 hour period shall be conducted 1 hour at -65°C, 2 hours at room temperature and 1 hour at 175°C. During the vibration, the series wired contacts shall be monitored for discontinuities at a direct current of 100 ma. Discontinuities of 1 microsecond or greater will constitute a failure.

6.10 Shock

The mated connectors shall be rigidly mounted on a shock test machine using a suitable test fixture and their normal mounting means. A minimum of 8 inches of wire shall be unsupported on both ends of the connectors. The connectors shall be subjected to one shock pulse in each direction of each of the three mutually perpendicular axes. Each pulse shall be of approximately half-sine waveform, 50G peak and 11 milliseconds duration. The series wired contacts shall be monitored for discontinuities at a direct current of 100 ma. Discontinuities of 1 microsecond or greater shall constitute failure.

6.11 Moisture Resistance (81511 Only)

The mated 81511 type connectors shall be subjected to the moisture resistance test of MIL-STD-202, Method 106, with step 7b vibration excluded. After a minimum of 3 hours after completion of the final cycle, while the connectors are still subjected to high humidity, the insulation resistance shall be measured as specified in 6.4 except that it shall be 500 megohms or greater.

6.12 Dielectric Withstanding Voltage at Altitude (81511 only)

The mated 81511 type connectors shall be tested as specified in 6.5 except that they shall be placed in a vacuum chamber and evacuated to a simulated altitude of 110,000 feet for 1/2 hour and then subjected to a test potential of 1000V AC RMS.

6.13 Insulation Resistance at Elevated Temperature

The insulation resistance of the mated connectors shall be measured as in 6.4 except that they shall have been subjected to a temperature of 175°C for 30 minutes prior to making the measurements. All measurements shall be in excess of 200 megohms.

6.14 Air Leakage

The unmated plugs and receptacles shall be mounted on a test fixture suitable for application of a pressure of 30 psig to the mating face. The assembly shall be soaked at a temperature of -65°C and then pressurized to 30 psig. The leakage rate shall not be more than 1 in ^{3}/hour.

6.15 Water Immersion (81511 only)

The mated 81511 type connectors shall be immersed in tap water to a depth of 6 ft. for a period of 48 hours. They shall then be removed from the water and insulation resistance will be measured as specified in 6.4 except that all measurements shall be in excess of 100 megohms.

6.16 Contact Resistance

The resistance of 25 contact sets of each mated connector shall be measured. The four wire method of MIL-C-23216C (Figure 4) shall be used. The voltage drop across a 6 in. length (contact set approximately in the middle) shall be measured at the following test currents:

Connector Type	Contact Size	Wire Size	Test Curr. Amps. DC	Maximum Potential Drop M.V. Initial	After Temperature Life & Salt Spray
81511	22D	24	3	55	65
81511	22D	28	1 1/2	35	45
Stub"E"	20	20	7 1/2	60	70

6.17 Salt Spray (81511 only)

The unmated 81511 type connectors shall be subjected to the salt spray test as specified in MIL-STD-202, Method 101, Test Condition B. The salt concentration shall be 5%. Following the exposure the connectors shall be washed off with tap water and dried in a circulating air oven at a temperature of 38° ± 3°C for 12 hours maximum, after which they shall be removed and inspected. The connectors shall be mated and unmated one cycle to insure mateability and to remove free salt deposits.

6.18 Durability

The mating 81511 type connectors shall be subjected to 500 cycles of mating and unmating at a maximum rate of 300 cycles per hour. The Stub "E" connectors will be similarly subjected to 200 cycles. The coupling mechanism will be operated in a manner to simulate actual service operation. The connectors shall show no mechanical or electrical defects detrimental to the operation of the connector.

6.19 Temperature Life

The mated connectors shall be subjected to a temperature of 175°C for a period of 1000 hours. At the end of 1000 hours, while at 175°C, the insulation resistance shall be measured as specified in 6.4 except that all measurements shall be in excess of 200 megohms.

6.20 Fluid Immersion

6.20.1 Hydraulic Oil MIL-H-5606

The unmated connectors shall be immersed in the hydraulic oil at room temperature for 20 hours. The parts shall be allowed to drain for 1 hour at room temperature prior to being subjected to the subsequent tests.

6.20.2 Lubricating Oil MIL-L-23699

The unmated connectors shall be tested as in 6.20.1 except that MIL-L-23699 lube oil shall be used.

6.21 Insert Retention (81511 only)

The inserts in the 81511 type connector shells shall have axial loads applied to their mating faces at a rate of approximately 10 lb/sec until a load equivalent to 75 psig is reached. This load shall be retained for a period of 10 to 15 seconds without becoming dislodged.

6.22 Final Examination of Product

At the completion of testing, the connectors shall be examined for general condition and damage considered to be abnormal for the tests to which the connectors have been exposed.

7.0 Test Report

A test report shall be written at the completion of testing which is to include all pertinent test information, copies of original test data and conclusions. The report shall be written in standard Bendix/ECD Engineering Laboratory Report format. Three copies of this report will be supplied to USAECOM, Fort Monmouth, New Jersey.

8.0 Equipment List

The following equipment or suitable equivalent will be used in performing the foregoing tests:

Torque Fixture	Sturtevant	ICF-100-I
Torque Wrench	Sturtevant	M-5-1S
Torque Wrench	Sturtevant	M-25-1S
Torque Wrench	Sturtevant	M-50-1S
Megohm Bridge	General Radio	1644A
Automatic Connector Tester	Bendix	F-1680
High Voltage A.C. Supply	Bendix	L-9947-25
Universal Testing Machine	Instron	TTC
Thermal Shock Machine	Blue-M	WSP109C-3
Vibration Test System	M-B	C-20
Shock Test Machine	Consol. Vac.	3" Hyge
Humidity Chamber	Blue-M	FR-386
Circulating Air Oven	Blue-M	POM-206C
Cold Chamber	Murphy & Miller	LTF-4-120
Constant Current Power Supply	Kepco	KS-18-10M
Digital Voltmeter	Hewlett Packard	3450A
Ammeter	Weston	931
Salt Spray Chamber	Ind. Filter & Pump Co.	411-1C
Connector Durability Machine	Bendix	44-76531

Lewis A. Armitage
Engineering Laboratory

ds

Engineering Laboratory Report

12-5204

EVALUATION

BURNDY POSITIVE LOCKING

CONTACT INSERTION TOOLS

DATE OF TEST: 1.30.73 TO 2.7.73

DATE OF REPORT: February 20, 1973

REPORTED BY: Robert J. Waghorn

APPROVED BY: Leonard A. Krantz

APPROVED BY: DC Baker 2/19/73

NOTED BY: Geo. Swanson

WITNESSED BY:

Bendix Electrical Components Division

Sidney, N. Y. 13838

ENGINEERING LABORATORY REPORT 12-5204

I. PURPOSE

The purpose of this test is to evaluate a contact insertion tool that will indicate if the contact is locked into the retention mechanism of an electrical device and determine its suitability as a universal terminal insertion tool for applications such as the IWTS type connector.

II. CONCLUSIONS

A. The tool satisfactorily performs the retention test on the wired contact when it is withdrawn from the connector after contact insertion.

B. The tool release force was not significantly affected by changes in the wire type, insulation finish and the finished OD of the wire. The 28 AWG wire MS22759/11 did lower the tool release force to a point where the tool did not properly release the wire or recycle.

C. The tools were easy to operate and are comfortable for the average size hand.

D. Working volume available behind a mounted electrical device for circuit modification or repair has to be equivalent to a cylinder six inches in diameter and ten inches long. Access to this working area is another consideration.

III. RECOMMENDATIONS

A. It is recommended that this type of insertion tool be utilized in electrical devices having "blind" insertions such as in the IWTS type connector.

B. It is also recommended that individual tools be gauged and set to accommodate specific OD ranges, as in the case of the 28 AWG wire.

IV. ACTION TAKEN

None.

V. DETAILED REPORT

Tools Submitted

One Burndy tool P/N RTM20D24 with tool release force set at 4.0 pounds, one Burndy tool P/N RTM20D24 modified with tool release force set for 1.8 to 2.3 pounds. The RTM20D24 tool was used with wire/contact combinations with Size 20 contacts. The modified tool was used with wire/contact combinations utilizing 22D contacts.

Sample Preparation

Fifteen pieces of each wire listed below and their corresponding pin and socket contacts were prepared and crimped using standard MS crimp tools. A pin and socket contact was put on opposite ends of each twelve inch length of MIL-W wire.

This list defines the size contact that shall be used in conjunction with each wire:

Table I

Contact	Wire	Finished OD	Actual OD
22D	M22759/11-28	.031-.035	.0335-.0345
	M16878/4-26	.035-.043	.0375-.038
	M81381/1-26	.034-.040	.0345-.0355
	M22759/9-26	.046-.050	.0465-.0485
	M81044/4-24	.038-.042	.040-.041
	M16878/4-24	.040-.048	.044-.045
	M16878/4-22	.046-.054	.049-.050
	M81381/1-22	.043-.050	.045-.047
20	M22759/7-24	.060-.064	.062-.066
	M16878/4-24	.040-.048	.044-.045
	MIL-W-5086A-22	.064-.072	.068-.070
	M22759/7-22	.071-.075	.0725-.074
	M81381/1-22	.043-.050	.045-.047
	MIL-W-5086A-20	.074-.082	.075-.0765
	MIL-W-22759		
	MS18104-20	.056-.060	.0585-.0595
	M22759/7-20	.080-.084	.0815-.0835
	M22759/11-20	.056-.060	.0585-.0595
	M81044/12-20	.053-.057	.053-.054

V. DETAILED REPORT (Continued)

Test Procedures and Results

Tests were performed following the outline of L-15081-92, Rev A, as modified by Burndy's letter dated 11/24/72.

A. Tool Release Force

Measurement of tool release force per wire type was measured using the Chatillon Automatic Force Measuring Device. An axial force was applied to the insertion tool to simulate a rate normally used when removing an insertion tool after inserting a contact into a connector. Every attempt was made to insure that the pull was axial and not off center. A different wire/contact combination was used for each measurement. The pin and socket of each wire was checked and a total of ten release forces were measured and recorded on Data Sheets 1, 2 and 3 of Appendix A.

The tool instruction sheets list 4.0 pounds as the release force for the unmodified tool and a range of 1.8 to 2.3 pounds for the modified tool. In general, the unmodified tool exhibited forces less than the 4.0 pounds indicated. The modified tool faired better with the range provided, but still had release forces of less than 1.8 pounds.

The modified tool did not complete its operational cycle (reset) on the first five wire/contact (28 AWG) combinations. The grip jaw area was blown off with approximately 90 psig of filtered air to clean the grips and possibly dislodge any foreign matter causing the malfunction. The tool seemed to perform satisfactorily throughout this phase of testing. The release and reset functioned as designed.

B. Tool Damage

The wire/contact samples used in the Tool Release Force test were inspected using a 12 power microscope. Examination for tool damage was of the area where the grip jaws secured the OD of the insulation. The general area was 2 to 2-1/4 inches and 3 to 3-1/4 inches back on the wire with respect to the crimp shoulder of the Size 20 and 22D contacts respectively. Only the slightest irregularity of the insulation OD was visible at 12 power and there was no apparent damage. This irregularity is more easily detected by moving a fingernail over the area in question.

V. DETAILED REPORT (Continued)

Attention was also paid to the magnitude of creepage of the insulation away from the contact crimp well. There was no evidence of insulation creepage.

C. Crimp Tensile

Five each of the listed wire/contact combinations were tested for crimp joint strength. The contacts at both ends of the wire were tested separately at a pull rate of one inch/minute. The five wire/contact combinations of the Tool Release Force test were also tested in a like manner. Comparison of the data from the two samplings does not indicate a significant difference in crimp joint tensile strengths. See Appendix A, Data Sheets 4 through 8.

D. Tool Use

The last five of each wire/contact combination were used to subjectively evaluate tool feel and ease of handling when inserting contacts into connectors. This was done in conjunction with the operator's past experience with other types of insertion and removal tools and mainly the MS27509 plastic tools used on the Bendix JT-R (MIL-C-38999) connector and the MS3447 insert-extract plastic tool used with the Bendix PT-DRE (MIL-C-0026482F) connector.

Both Burndy tools were easy to handle. The operation to check positive locking of the contact seemed to be consistent and the mechanics smooth. The modified tool used on 22D contacts with the smaller finished OD wires did not function well until used on the wires with .040" or more. The tool has to perform two steps to ready the tool for a subsequent contact insertion. 1) It must perform the retention test to assure the contact is secured by the retention mechanism. 2) Simultaneously with the tool release, the grip jaws should snap open. The second function did not consistently occur when the tool was used with the wires having a finished OD of less than .040". Thus, the "no-cycle" button has to be employed before the insertion of another wired contact can be made.

Also, the minimum working volume required behind an electrical device in order to easily operate this type of tool, insert a contact and withdraw the tool conveniently, was determined in the following manner.

V. DETAILED REPORT (Continued)

This is also dependent on the accessibility of the item to be modified or repaired. The diameter of the working area for one's hand on the tool and the ability to place the hand in a position to place the wired termination into the tool is approximately six inches. The tool with a wired termination is approximately ten inches in length. Hence, this working volume needs to be the shape of a cylinder ten inches long and six inches in diameter.

VI. REFERENCES

CLT 3282, ECL-0538-92 to -95, ECL-0538B-25 to -32
L-15081-92, Rev A (Bendix Procedure)
Letter dated 11/14/72, J. D. Anderson to D. H. Gould (Burndy to Bendix)

APPENDIX A

DATA SHEETS

LABORATORY DATA SHEET

TEST	TOOL RELEASE FORCE
DATE OF TESTS	1.29 & 30.73
REPORT NUMBER	12-5201
TEST SPECIMEN (S)	BURNDY TOOL P/N RTM20D24 W/ WIRE & CONTACTS AS LISTED
LT.	3282
TEMP.	74°F
R.H.	34%
ECL / EPL	ECL 0538B-25
SPEC.	
PARA.	
SPEC. LIMITS	
TEST CONDITIONS	ROOM AMBIENT. TOOL RELEASE SET @ 4 LBS.

TEST EQUIPMENT	CAL. DATE	DUE DATE
CHATILLON AUTOMATIC FORCE MEASURING DEVICE F-4511	PRIOR TO USE	
DAYTRONIC MODEL 300D T.A.I TRANSDUCER AMPLIFIER INDICATOR F-1536	10.31.72	5.25.73
HONEYWELL ELECTRONIK 19 RECORDER F-1366	12.7.72	3.6.73
OHAUS STO-A-WEIGH SET PG 1008	1.18.73	2.8.73

MS22759/7-24	TOOL RELEASE FORCE IN POUNDS	M16878/4-24	TOOL RELEASE FORCE IN POUNDS	MIL-W-5086 I -22	TOOL RELEASE FORCE IN POUNDS	M22759/7-22	TOOL RELEASE FORCE IN POUNDS
SIZE 20 PINS 1	3.85	SIZE 20 PINS 1	3.65	SIZE 20 PINS 1	4.1	SIZE 20 PINS 1	3.7
2	3.65	2	3.55	2	4.05	2	3.65
3	3.65	3	3.6	3	4.0	3	3.6
4	3.7	4	3.55	4	4.1	4	3.45
5	3.85	5	3.6	5	4.1	5	3.7
SIZE 20 SOCKETS 1	3.75	SIZE 20 SOCKETS 1	3.45	SIZE 20 SOCKETS 1	4.0	SIZE 20 SOCKETS 1	3.65
2	3.85	2	3.55	2	4.15	2	3.7
3	3.75	3	3.45	3	4.3	3	3.85
4	3.7	4	3.6	4	4.0	4	3.7
5	3.6	5	3.8	5	4.05	5	3.65
$\bar{X}$	3.74	$\bar{X}$	3.58	$\bar{X}$	4.09	$\bar{X}$	3.67
$\bar{X}+3\sigma$	4.0	$\bar{X}+3\sigma$	3.87	$\bar{X}+3\sigma$	4.35	$\bar{X}+3\sigma$	3.95
$\bar{X}-3\sigma$	3.47	$\bar{X}-3\sigma$	3.29	$\bar{X}-3\sigma$	3.82	$\bar{X}-3\sigma$	3.38

M81381/1-22	T.R.F. IN POUNDS	MIL-W-5086 I-22	T.R.F. IN POUNDS	MIL-W-22759 MS18104-20	T.R.F IN POUNDS	M22759/7-20	T.R.F. IN POUNDS
SIZE 20 PINS 1	3.2	SIZE 20 PINS 1	4.45	SIZE 20 PINS 1	3.25	SIZE 20 PINS 1	4.25
2	3.25	2	4.25	2	4.05	2	3.85
3	3.25	3	4.15	3	3.85	3	3.9
4	3.5	4	4.2	4	3.8	4	3.8
5	3.4	5	4.05	5	3.8	5	3.95
SIZE 20 SOCKETS 1	3.3	SIZE 20 SOCKETS 1	4.05	SIZE 20 SOCKETS 1	3.8	SIZE 20 SOCKETS 1	4.1
2	3.25	2	4.05	2	4.0	2	3.9
3	3.3	3	4.15	3	3.95	3	4.1
4	3.45	4	4.2	4	4.05	4	4.05
5	3.5	5	4.1	5	3.95	5	4.15
$\bar{X}$	3.34	$\bar{X}$	4.17	$\bar{X}$	3.85	$\bar{X}$	4.01
$\bar{X}+3\sigma$	3.66	$\bar{X}+3\sigma$	4.51	$\bar{X}+3\sigma$	4.51	$\bar{X}+3\sigma$	4.42
$\bar{X}-3\sigma$	3.02	$\bar{X}-3\sigma$	3.82	$\bar{X}-3\sigma$	3.19	$\bar{X}-3\sigma$	3.59

REF. ECL0538-93 & -94.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY R.D. WAGHORN
APPROVED BY [signature]
WITNESSED BY

72-354-2

1.

LABORATORY DATA SHEET

TEST: TOOL RELEASE FORCE		DATE OF TESTS: 1·29 & 30·73	REPORT NUMBER: 12-5207
TEST SPECIMEN (S): BURNDY TOOL P/N RTM20D24 W/ WIRE & CONTACTS AS LISTED.	LT. 3282	TEMP. 74°F. R.H. 34%	ECL05388-26
		SPEC.	PARA.

TEST EQUIPMENT	CAL. DATE	DUE DATE
CHATILLON AUTOMATIC FORCE MEASURING DEVICE E-4511	PRIOR TO	USE
DAYTRONIC MODEL 300D T.A.I TRANSDUCER AMPLIFIER INDICATOR F-1536	10·31·72	4·25·73
HONEYWELL ELECTRONIK 19 RECORDER F-1366	12·7·72	3·6·73
OHAUS STD-A-WEIGH SET PG 1008	1·18·73	2·8·73

SPEC. LIMITS

TEST CONDITIONS: ROOM AMBIENT: TOOL RELEASE SET @ 4 LBS.

MS22754/11-20	TOOL RELEASE FORCE IN POUNDS	M81044/12-20 -9	T.R.F. IN POUNDS
SIZE 20 PINS 1	3.5	SIZE 20 PINS 1	4.05
2	3.55	2	4.5
3	3.65	3	4.3
4	3.7	4	4.1
5	3.75	5	4.35
SIZE 20 SOCKETS 1	3.75	SIZE 20 SOCKETS 1	4.95
2	3.95	2	4.15
3	3.8	3	4.2
4	3.8	4	3.8
5	3.75	5	4.35
$\bar{X}$	3.72	$\bar{X}$	4.28
$\bar{X}+3\sigma$	4.09	$\bar{X}+3\sigma$	5.15
$\bar{X}-3\sigma$	3.35	$\bar{X}-3\sigma$	3.40

REF. ECL0538-93 & -94.

Bendix Electrical Components Division
Sidney New York 13838

TESTED BY R.D. WAGHORN

APPROVED BY [signature]

WITNESSED BY

72-354-2

2.

LABORATORY DATA SHEET

TEST: TOOL RELEASE FORCE		DATE OF TESTS: 1.29 & 30.73	REPORT NUMBER: 12-5207
TEST SPECIMEN (S): BURNDY TOOL P/N RTM20D24 MODIFIED, W/ WIRE & CONTACTS AS LISTED	LT. 3282	TEMP. 74°F. R.H. 34%	ECL 05388-27 EDL
		SPEC.	PARA.

TEST EQUIPMENT	CAL DATE	DUE DATE
CHATILLON AUTOMATIC FORCE MEASURING DEVICE E-4511	PRIOR TO	USE
DAYTRONIC MODEL 300D T.A.I TRANSDUCER AMPLIFIER INDICATOR F-1536	10.31.72	4.25.73
HONEYWELL ELECTRONIK 19 RECORDER F-1366	12.7.72	3.6.73
OHAUS STD-A-WEIGH SET PG 1008	1.18.73	2.8.73

SPEC. LIMITS

TEST CONDITIONS: ROOM AMBIENT. TOOL RELEASE SET @ 2LBS. 1.8 TO 2.3 LBS.

MS22759/11-23	TOOL RELEASE FORCE IN POUNDS	M16878/4-26	T.R.F. IN POUNDS	M81381/1-26	T.R.F. IN POUNDS	M22759/9-26	T.R.F. IN POUNDS
SIZE 22D PINS 1	1.65	SIZE 22D PINS 1	2.15	SIZE 22D PINS 1	1.7	SIZE 22D PINS 1	2.0
2	1.7	2	2.0	2	1.7	2	1.95
3	1.5	3	2.05	3	1.75	3	2.15
4	1.35	4	1.95	4	1.75	4	2.0
5	1.45	5	2.0	5	1.75	5	1.95
SIZE 22D SOCKETS 1	1.65	SIZE 22D SOCKETS 1	2.0	SIZE 22D SOCKETS 1	1.75	SIZE 22D SOCKETS 1	1.9
2	1.55	2	1.85	2	1.75	2	2.0
3	1.55	3	2.0	3	1.75	3	2.05
4	1.5	4	2.0	4	1.75	4	2.0
5	1.7	5	1.9	5	1.75	5	1.9
$\bar{X} \rightarrow$	1.56		1.99		1.74		1.99
$\bar{X}+3\sigma \rightarrow$	1.89		2.22		1.80		2.20
$\bar{X}-3\sigma \rightarrow$	1.23		1.76		1.68		1.78

M81044/4-24	T.R.F. IN POUNDS	M16878/4-24	T.R.F. IN POUNDS	MIL-W-16878/4-22	T.R.F. IN POUNDS	M81381/1-22	T.R.F. IN POUNDS
SIZE 22D PINS 1	1.8	SIZE 22D PIN 1	2.0	SIZE 22D PINS 1	2.1	SIZE 22D PINS 1	1.6
2	1.8	2	1.85	2	1.9	2	1.6
3	1.8	3	1.9	3	1.9	3	1.9
4	1.9	4	1.9	4	1.85	4	1.6
5	1.9	5	1.85	5	1.8	5	2.15
SIZE 22D SOCKETS 1	1.85	SIZE 22D SOCKETS 1	1.9	SIZE 22D SOCKETS 1	2.0	SIZE 22D SOCKETS 1	1.6
2	1.9	2	1.9	2	1.95	2	1.55
3	1.95	3	1.85	3	1.95	3	1.65
4	1.8	4	1.9	4	1.9	4	1.95
5	1.85	5	1.95	5	1.9	5	1.75
$\bar{X} \rightarrow$	1.86		1.90		1.93		1.74
$\bar{X}+3\sigma \rightarrow$	2.01		2.03		2.16		2.30
$\bar{X}-3\sigma \rightarrow$	1.70		1.77		1.69		1166

REF. ECL0538-93 & -94.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY R.D. WASHORN

APPROVED BY JAK

WITNESSED BY

3.

72-354-2

LABORATORY DATA SHEET

TEST CRIMP TENSILE		DATE OF TESTS 2.1 TO 2.5.73	REPORT NUMBER 12-52.04
TEST SPECIMEN (S) WIRE/CONTACT COMBINATIONS AS LISTED.		TEMP. 74°F. R.H. 34%	ECL0538B-28 ~~EPL~~
	LT. 3282	SPEC.	PARA.

TEST EQUIPMENT		CAL. DATE	DUE DATE
INSTRON	PG1050	8.25.72	2.25.73
INSTRON	PG1077	10.17.72	4.17.73

SPEC. LIMITS

TEST CONDITIONS
ROOM AMBIENT.
CRIMP TENSILE FORCES IN LBS.
RATE OF 1 IN/MIN.

MS22759/7-24	T.R.F. SAMPLES CRIMP TENSILE IN POUNDS	CRIMP TENSILE SAMPLES IN POUNDS	M16878/4-24	T.R.F. SAMPLES CRIMP TENSILE IN POUNDS	CRIMP TENSILE SAMPLES IN POUNDS
SIZE 20 PINS 1	10.4 WBC	12.9 WB	SIZE 20 PINS 1	11.2 WBC	11.3 WBC
2	11.2 WBC	9.5 WBC	2	11.0 "	11. "
3	9.0 WBC	11.3 "	3	10.7 "	11.3 "
4	10.6 WBC	10.8 "	4	10.9 "	10.5 "
5	10.0 "	12.9 WB	5	10.5 "	11.3 "
SIZE 20 SOCKETS 1	12.2 "	10.8 WBC	SIZE 20 SOCKETS 1	11.2 "	11.5 "
2	12.4 "	12.8 WB	2	10.8 "	12.0 "
3	11.2 "	11.0 WBC	3	12.0 "	11.6 "
4	11.2 "	11.8 "	4	11.6 "	12.0 "
5	12.7 "	11.1 "	5	10.8 "	11.0 "
$\bar{X}$	11.09	11.49	$\bar{X}$	11.07	11.35
$\bar{X}+3\sigma$	14.36	14.66	$\bar{X}+3\sigma$	12.35	12.66
$\bar{X}-3\sigma$	7.82	8.33	$\bar{X}-3\sigma$	9.79	10.04

MIL-W-25061-22	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES	M22759/7-22	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 20 PINS 1	21.5 WBC	21.0 WBC	SIZE 20 PINS 1	20.0 WBC	20.0 WB
2	21.5 "	21.0 "	2	20.5 "	20.0 "
3	21.5 "	21.5 "	3	20.5 WB	20.0 "
4	22.0 "	21.5 "	4	20.0 WBC	20.5 "
5	19.5 "	21.0 "	5	20.0 WBC	20.0 WBC
SIZE 20 SOCKETS 1	22.0 "	21.0 "	SIZE 20 SOCKETS 1	20.0 WB	20.0 WB
2	21.0 "	21.5 "	2	20.5 "	20.5 "
3	18.0 "	21.0 "	3	20.0 "	20.5 "
4	20.5 "	21.0 "	4	20.5 "	20.5 "
5	21.5 "	22.0 "	5	20.0 "	20.0 "
$\bar{X}$	20.90	21.25	$\bar{X}$	20.2	20.2
$\bar{X}+3\sigma$	24.50	22.26	$\bar{X}+3\sigma$	20.94	20.94
$\bar{X}-3\sigma$	17.30	20.24	$\bar{X}-3\sigma$	19.47	19.47.

REF.
ECL0538-93 & -94.
WB - WIRE BROKE.
WBC - " " AT CRIMP.
WPO - " PULLED OUT.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY R.D. WAGHORN
APPROVED BY [signature]
WITNESSED BY

72-354-2

LABORATORY DATA SHEET

TEST: CRIMP TENSILE		DATE OF TESTS: 2.1 TO 2.5.73	REPORT NUMBER: 12-52.01
TEST SPECIMEN (S): WIRE/CONTACT COMBINATIONS AS LISTED.		TEMP: 74°F. / R.H.: 34%	ECL 0538B-29
	LT. 3282	SPEC.	PARA.

TEST EQUIPMENT		CAL. DATE	DUE DATE	SPEC. LIMITS / TEST CONDITIONS
INSTRON	PG 1050	8.25.72	2.25.73	ROOM AMBIENT.
INSTRON	PG 1077	10.17.72	4.17.73	CRIMP TENSILE FORCES IN LBS.
				PULL RATE 1 IN./MIN.

[illegible]81/1-22	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 20 PINS 1	19.0 WBC	19.5 WBC
2	18.5 "	19.0 "
3	19.0 "	17.5 "
4	18.5 "	19.0 "
5	19.0 "	18.0 "
SIZE 20 SOCKETS 1	18.0 "	18.0 "
2	19.0 "	18.5 "
3	17.5 "	19.5 "
4	17.0 "	17.5 "
5	17.0 "	18.5 "
$\bar{X}$	18.25	18.50
$\bar{X}+3\sigma$	20.60	20.62
$\bar{X}-3\sigma$	15.90	16.38

MIL-W-5086, TYPE I -20	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 20 PINS 1	34.5 WBC	35.5 WBC
2	35.5 "	36.5 "
3	32.5 "	36.0 "
4	34.5 "	36.5 "
5	36.5 "	36.0 "
SIZE 20 SOCKETS 1	36.0 "	36.0 "
2	35.5 "	36.5 "
3	35.5 "	37.0 "
4	34.5 "	36.5 "
5	35.5 "	37.5 "
$\bar{X}$	35.05	36.40
$\bar{X}+3\sigma$	38.23	38.02
$\bar{X}-3\sigma$	31.87	34.78

MIL-W-22759 [illegible]18104-20	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 20 PINS 1	33.5 WBC	31.5 WBC
2	31.0 "	32.5 "
3	31.0 "	32.5 "
4	30.5 "	31.5 "
5	30.5 "	31.5 "
SIZE 20 SOCKETS 1	32.5 "	33.0 "
2	32.5 "	33.5 "
3	33.0 "	33.0 "
4	32.5 "	33.5 "
5	32.5 "	32.5 "
$\bar{X}$	31.95	32.50
$\bar{X}+3\sigma$	35.06	34.73
$\bar{X}-3\sigma$	28.84	30.28

M22759/7-20	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 20 PINS 1	30.5 WBC	31.0 WBC
2	28.5 "	[illegible] "
3	30.5 "	30.5 "
4	30.5 "	31.5 "
5	31.5 "	32.0 "
SIZE 20 SOCKETS 1	31.0 "	31.0 "
2	31.5 "	31.5 "
3	32.0 "	32.0 "
4	31.5 "	31.0 "
5	32.0 "	32.5 "
$\bar{X}$	30.95	31.15
$\bar{X}+3\sigma$	33.91	33.28
$\bar{X}-3\sigma$	27.99	29.02

REF. ECL0538-93 & -94
WB – WIRE BROKE
WBC – " " AT CRIMP
WPO – " PULLED OUT.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY R. D. WAGHORN
APPROVED BY [illegible]
WITNESSED BY

5.

72-354-2

LABORATORY DATA SHEET

TEST CRIMP TENSILE			DATE OF TESTS 2·1 TO 2·5·73	REPORT NUMBER 12-52.04
TEST SPECIMEN (S) WIRE/CONTACT COMBINATIONS AS LISTED			TEMP. 74°F. R.H. 54%	ECL 05388-30 ~~EPL~~
		LT. 3282	SPEC.	PARA.
TEST EQUIPMENT	CAL. DATE	DUE DATE	SPEC. LIMITS	
INSTRON PG 1050	8·25·72	2·25·73	TEST CONDITIONS	
INSTRON PG 1077	10·17·72	4·17·73	ROOM AMBIENT. CRIMP TENSILE FORCES IN LBS. PULL RATE 1 IN./MIN.	

MS22759/11-20	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES	M81044/12-20-9	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 20 PINS 1	32.0 WBC	31.0 WBC	SIZE 20 PINS 1	36.5 WBC	37.0 WBC
2	32.0 "	32.0 "	2	36.5 "	37.0 "
3	32.0 "	31.5 "	3	37.0 "	37.0 "
4	32.0 "	31.0 "	4	36.5 "	37.5 "
5	30.5 "	32.5 "	5	36.5 "	37.5 "
SIZE 20 SOCKETS 1	32.0 "	32.5 "	SIZE 20 SOCKETS 1	34.5 "	36.5 "
2	33.0 WB	30.5 "	2	34.5 "	36.0 "
3	32.5 WBC	32.0 "	3	35.5 "	35.5 "
4	32.5 "	32.0 "	4	37.5 "	36.5 "
5	32.5 "	32.5 WB	5	36.5 "	36.5 "
$\bar{X}$	32.10	31.71	$\bar{X}$	36.15	36.70
$\bar{X}+3\sigma$	33.97	33.65	$\bar{X}+3\sigma$	39.00	38.50
$\bar{X}-3\sigma$	30.23	29.77	$\bar{X}-3\sigma$	33.30	34.90

REF.
ECL0538-93 & 94.
WB - WIRE BROKE.
WBC - " " AT CRIMP.
WPO - " PULLED OUT.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY R.D. WAGHORN
APPROVED BY [signature]
WITNESSED BY

72-354-2

6.

LABORATORY DATA SHEET

TEST CRIMP TENSILE	DATE OF TESTS 2.1 TO 2.5.73
REPORT NUMBER	12-5201
TEST SPECIMEN (S) WIRE/CONTACT COMBINATIONS AS LISTED	TEMP 79°F. R.H. 34%
ECL05386-31	
LT. 3282	SPEC.	PARA.

TEST EQUIPMENT		CAL. DATE	DUE DATE
INSTRON	PG 1050	8.25.72	2.25.73
INSTRON	PG 1077	10.17.72	4.17.73

SPEC. LIMITS

TEST CONDITIONS
ROOM AMBIENT.
CRIMP TENSILE FORCES IN LBS.
PULL RATE 1 IN./MIN.

M22759/11-28	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES	M16878/4-26	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 22D PINS 1	3.2 WBC	4.0 WBC	SIZE 22D PINS 1	8.9 WBC	8.9 WBC
2	4.0 "	3.7 "	2	8.5 "	8.7 "
3	3.1 "	3.3 "	3	8.3 "	8.7 "
4	4.3 "	2.7 "	4	8.1 "	8.3 "
5	4.1 "	2.4 "	5	9.0 "	8.9 "
SIZE 22D SOCKETS 1	4.9 "	4.0 "	SIZE 22D SOCKETS 1	8.5 "	7.9 "
2	3.2 "	4.6 "	2	8.8 "	8.7 "
3	4.2 "	4.2 "	3	9.0 WB	8.9 "
4	3.2 "	4.5 "	4	8.7 WBC	8.8 "
5	4.6 "	4.4 "	5	8.3 "	8.2 "
$\bar{X}$	3.83	3.78	$\bar{X}$	8.71	8.55
$\bar{X}+3\sigma$	5.50	5.93	$\bar{X}+3\sigma$	9.91	9.50
$\bar{X}-3\sigma$	2.16	1.63	$\bar{X}-3\sigma$	7.51	7.60
M81481/1-26	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES	M22759/9-26	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 22D PINS 1	6.8 WBC	7.2 WBC	SIZE 22D PINS 1	6.5 WBC	7.0 WBC
2	7.6 "	7.4 "	2	6.6 "	7.1 "
3	7.1 "	6.8 "	3	7.0 "	7.2 "
4	8.3 "	7.5 "	4	7.2 "	7.3 "
5	7.6 "	7.3 "	5	7.3 "	6.4 "
SIZE 22D SOCKETS 1	8.0 "	7.0 "	SIZE 22D SOCKETS 1	7.7 "	6.9 "
2	7.7 "	7.3 "	2	5.9 "	7.4 "
3	6.1 "	7.9 "	3	6.9 "	7.8 "
4	7.9 "	7.8 "	4	7.7 "	6.9 "
5	6.4 "	5.8 "	5	6.3 "	7.6 "
$\bar{X}$	7.35	7.20	$\bar{X}$	6.91	7.11
$\bar{X}+3\sigma$	9.40	8.89	$\bar{X}+3\sigma$	8.59	8.42
$\bar{X}-3\sigma$	5.29	5.51	$\bar{X}-3\sigma$	5.23	5.80

REF.
ECL0538-93 & -94.
WB - WIRE BROKE.
WBC - " " AT CRIMP.
WPO - " PULLED OUT.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY R.D. WAGHORN

APPROVED BY [signature]

WITNESSED BY

72-354-2

7.

LABORATORY DATA SHEET

TEST CRIMP TENSILE		DATE OF TESTS 2/TO 2.5.73	REPORT NUMBER 12-5204
TEST SPECIMEN (S) WIRE/CONTACT COMBINATIONS AS LISTED		TEMP. 74°F. R.H. 34%	ECL 0538 B-32
	LT. 3282	SPEC.	PARA.

TEST EQUIPMENT		CAL. DATE	DUE DATE	SPEC. LIMITS
INSTRON	PG 1050	8.25.72	2.25.73	
INSTRON	PG 1077	10.17.72	4.17.73	TEST CONDITIONS ROOM AMBIENT CRIMP TENSILE FORCES IN LBS. PULL RATE 1 IN./MIN.

MB1099/4-24	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES		M16878/4-24	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES
SIZE 22D PINS 1	13.1 WBC	9.8 WBC		SIZE 22D PINS 1	12.3 WBC	12.6 WBC
2	12.0 "	13.0 "		2	11.0 "	12.9 "
3	12.3 "	10.1 WPO		3	12.2 "	12.4 "
4	10.2 "	13.7 WBC		4	12.3 "	11.8 "
5	12.6 "	12.9 "		5	12.9 "	12.5 "
SIZE 22D SOCKETS 1	11.0 "	10.6 "		SIZE 22D SOCKETS 1	11.8 "	12.4 "
2	11.9 "	11.6 "		2	12.6 WB	12.8 "
3	12.9 "	12.0 "		3	12.3 WBC	12.8 "
4	13.0 "	13.0 "		4	12.5 "	12.9 "
5	11.3 "	11.8 "		5	11.6 "	12.7 "
$\bar{X}$	12.03	11.85		$\bar{X}$	12.15	12.15
$\bar{X}+3\sigma$	14.75	15.66		$\bar{X}+3\sigma$	13.71	13.43
$\bar{X}-3\sigma$	9.31	8.05		$\bar{X}-3\sigma$	10.59	11.63

M16878/4-22	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES		MB1381/1-22	T.R.F. SAMPLES CRIMP TENSILE	CRIMP TENSILE SAMPLES.
SIZE 22D PINS 1	19.5 WBC	20.0 WBC		SIZE 22D PINS 1	18.0 WBC	16.0 WPO
2	19.5 "	20.0 "		2	19.5 WB	19.5 WB
3	20.5 "	19.5 "		3	19.0 WBC	20.0 "
4	19.5 "	20.0 "		4	19.0 "	17.5 WBC
5	20.5 WB	18.5 "		5	19.0 WB	19.0 WBC
SIZE 22D SOCKETS 1	19.5 WBC	19.5 "		SIZE 22D SOCKETS 1	19.5 WBC	14.5 "
2	19.0 "	18.0 "		2	18.5 "	17.5 "
3	18.5 "	18.5 "		3	17.0 "	16.5 "
4	19.0 "	19.0 "		4	18.5 "	19.0 "
5	17.5 "	18.5 "		5	19.0 "	18.5 "
$\bar{X}$	19.30	19.15		$\bar{X}$	18.70	17.8
$\bar{X}+3\sigma$	21.83	21.28		$\bar{X}+3\sigma$	20.84	22.74
$\bar{X}-3\sigma$	16.77	17.02		$\bar{X}-3\sigma$	16.56	12.86

REF. ECL0538-93 & -94.
WB - WIRE BROKE.
WBC - " " AT CRIMP.
WPO - " PULLED OUT.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY R. D. WAGHORN
APPROVED BY [signature]
WITNESSED BY

72-354-2

8.

L-15081-92 REV. A

EVALUATION, BURNDY

POSITIVE LOCKING

CONTACT INSERTION TOOLS

THE BENDIX CORPORATION
ELECTRICAL COMPONENTS DIVISION
SIDNEY, NEW YORK

1.0 Scope

The purpose of this procedure is to establish the Bendix/ECD Engineering Laboratory's evaluation methods and tests that will be used to determine the suitability of the Burndy positive locking contact insertion tools and to establish a common reference for all interested parties.

2.0 Test Agency

All tests described herein will be performed at and by the Engineering Laboratory, Electrical Components Division, The Bendix Corporation, Sidney, New York 13838.

3.0 Test Samples

3.1 Tools

Two typical tools, Burndy No. RTM20D24MOD and RTM20024, shall be submitted for test. These tools shall be used to evaluate the design of the subject tool and determine their suitability as a universal insertion tool for the IWTS connector.

3.2 Wire & Connectors

3.2.1 Connectors

Standard Bendix JT type connectors which are designed for the following size contacts shall be used:

22D
22
20

This is because the terminal and retention system used for the IWTS connector is that of the standard JT connector.

3.2.2 Wire

The following list of MIL-W wire shall be prepared in twelve (12) inch lengths. This list defines the size contact that shall be used in conjunction with each wire:

Table I

Contact	Wire	Finished OD
22D	M22759/11-28	.031-.035
	M16878/4-26	.035-.043
	M81381/1-26	.034-.040

Contact	Wire	Finished OD
22D	M22759/9-26	.046-.050
	M81044/4-24	.038-.042
	M16878/4-24	.040-.048
	M16878/4-22	.046-.054
	M81381/1-22	.043-.050
22	M22759/9-26	.046-.050
	M16878/4-26	.035-.043
	M81381/1-26	.034-.040
	M16878/4-24	.040-.048
	M81044/4-24	.038-.042
	M16878/4-22	.046-.054
	M81381/1-22	.043-.050
20	M22759/7-24	.060-.064
	M16878/4-24	.040-.048
	MIL-W-5086A-22	.064-.072
	M22759/7-22	.071-.075
	M81381/1-22	.043-.050
	MIL-W-5086A-20	.074-.082
	MIL-W-22759	
	MS18104-20	.056-.060
	M22759/7-20	.080-.084
	M22759/11-20	.056-.060
	M81044/4-20	.054-.062

At least 15 pieces of each wire shall be prepared. There will be a corresponding number of contacts.

3.2.3 Preparation

Each of the above wires and corresponding contacts, pins, will be prepared and crimped using standard MS tools. A contact will be put on each end of the above wires.

4.0 Testing

The tests shall consist of subjecting each contact/wire to the tests outlined in Table II. The tests shall be performed on each contact/wire sample in the sequence listed. Unless otherwise specified, all tests shall be performed under prevailing room ambient conditions which can fall anywhere within the following ranges:

Temperature 15° to 35°C (59° to 95°F)
Relative Humidity 30 to 90%
Barometric Pressure 650 to 800 Torr

Table II

	Examination of Product	5.1
I	Tool Release Force	5.2
II	Tool Damage	5.3
III	Crimp Tensile	5.4
IV	Tool Use	5.5
V	Contact Insertion Forces	5.6

5.0 Test Methods

Unless otherwise specified or directed, the tests of Table II shall be performed as described using the equipment listed herein or Engineering approved equivalent. All data/measurements shall be recorded on standard laboratory data sheets. In all cases, the instruction sheets for each tool shall be strictly followed.

5.1 Examination of Product

All wires shall be inspected for nicks resulting from stripping and any damage to the insulation that would compromise the operation of the tool or physical characteristics of the contact/wire crimp joint.

5.2 Tool Release Force

The release force of each tool shall be measured on the Instron at .1, 1, and 10 inch/minute. Steel wire, appropriately grit blasted, of 20, 18, 16, 14 and 12 gage shall be used. Each reading shall be repeated five (5) times and averaged. If the results from the steel wire prove to be unreliable or not repeatable, M16878/4 wire of 20 and 22 AWG in the -24 and -24 MOD tool shall be used. Each time the tool is used with the M16878/4 wire, a new section of the wire shall be placed under the gripper. Every attempt shall be made to see that the pull is axial and not off center.

5.3 Tool Damage

Five samples of the wire listed in Table I shall be subjected to the same tensile test as above. The RTM20D24 tool shall be used with the 20 gage wired contacts and the MOD tool shall be used with the size 22 and 22D contacts. The results obtained shall be statistically compared to the results from Para. 5.2 above. The wires shall also be inspected for tool damage to the wire and the location of the damage with respect to the crimp shoulder of the contact. Attention shall also be paid to the magnitude of insulation creepage away from contact crimp well. This shall be measured for later analysis.

5.4 Contact Tensile

Using the Instron at 1 inch/minute, the crimp tensile of five wires of each contact/wire combination in Table I shall be measured. Both contacts on each end of the wire shall be pulled. The five contact/wire combinations tested in Para. 5.3 shall also be tested. The results shall be statistically compared for significant differences.

5.5 Tool Use

Selecting 5 of each contact/wire combinations from Table I, a subjective evaluation of tool feel and ease of handling shall be made. This will be made in conjunction with the present standard JT-R plastic tools. A determination shall also be made of the minimum working volume required behind the connector in order to insert the contact and withdraw the tool.

5.6 Contact Insertion Force

In conjunction with the evaluation of Para. 5.5, the force necessary to install the tool and contact into the connectors shall be measured. The force necessary to remove the tool shall also be measured. A tensile/compression load cell and a strip chart recorder with the appropriate load cell amplifier shall be used. The force required to seat the contact-tool combination shall be measured first. As the tool is withdrawn, the force necessary to remove it will be recorded.

There will be several cavities with no or permanently damaged clips in the connectors so that the contact cannot be locked in place. The force necessary to remove the contact and tool shall be measured. Special attention shall be paid as to whether the grommet interference on the tool tip and contact is enough to pull the contact out of the tip by forcing the release mechanism to function. The force necessary to pull the tool tip and contact from the grommet shall be measured by removing the tool from the tip and pulling on the wire of the contact. A third force shall be measured, and that is the force necessary to remove the contact and an appropriate removal tool from the grommet. Install the removal tool, release the contact, and pull on the wire. All three forces shall be compared to determine if the release force on the tool is enough to determine if a contact is properly locked in place and if the contact is not locked, that the force is adequate to remove the unlocked contact and not leave it in the grommet. Also, a comparison shall be made as to the effect of wire insulation on the above.

5.7 Final Report

A final report shall be submitted; one good quality reproducible copy to Signal Corps for their approval. This report shall contain:

1) Title Page
2) Purpose
3) Conclusions
4) Recommendations
5) Action Taken
6) Details
7) References
8) Appendices W/All Data Sheets

This report shall be written in accordance with standard Bendix-ECD Engineering Laboratory procedures. Bendix/ECD judgements of the test results will appear in the Conclusions and Action Taken sections of the report which shall be subject to the acceptance and approval of the Signal Corps.

Leonard A. Krantz

Engineering Laboratory

BURNDY

November 14, 1972

Bendix Corp.
Electrical Components Div.
Sidney, New York 13838

Attention: Mr. Donald H. Gould

Subject: Approval - Evaluation, Burndy Positive Locking Contact Insertion Tools

Gentlemen:

We have reviewed document L-15081-92 Rev. A, Evaluation, Burndy Positive Locking Contact Insertion Tools and have the following comments:

5.2 Tool Release Force
"The release force of each tool shall be measured on the Instron at .1, 1, and 10 inch/minute. Steel wire, appropriately grit blasted, of 20, 18, 16, 14 and 12 gage shall be used. Each ...... "

Comment: We advised previously against the use of steel wire. Since that time we have experimented further with actuating the tool on bare steel wire and have determined beyond any doubt that the gripping jaws are damaged. The performance of the tool is rendered un-acceptable by use on steel wire. The gripping jaws, gripper slide angle, spring forces, etc., have been developed for proper performance on insulated electrical wire of the types specified for the contacts accommodated by the tools. For gripping on steel wire these components would have to be changed considerably, which would render them unfit for use on insulated electrical wire.

Please remove the use of steel wire in the tools and use actual insulated wire (such as the M16878/4 you have indicated).

5.6 Contact Insertion Force
3rd and 4th sentences, 2nd paragraph - "Special attention shall be paid as to whether the grommet interference on the tool tip and contact is enough to pull the contact out of the tip by forcing the release mechanism to function. The force necessary to pull the tool tip and contact from the grommet shall be measured by removing the tool from the tip and pulling on the wire of the contact."

Comment: The forces measured in sentence 4 above will have no relevance to the operation of the tool. As we reported in our March 8, 1972 reply - - "It is important to understand that any push or pull forces acting on the insertion tip of the tool

are not transmitted to the tool mechanisms which control tensile pull and release of the contact wire. The insertion tip is held by the tool body and forces on it are transmitted directly to the tool body. The only exception to this are the frictional drag forces between the insertion tip inside diameter, the contact, and the wire. Provided the wire diameter does not exceed the I.D. of the insertion tip, these friction forces are minimal and have been accounted for in the force setting adjustment of the tool."

Put another way, the only means by which pulling forces can be transmitted from the insertion tip to the wire and contact, or vice-versa, is that small amount transmitted by the frictional resistance to the wire sliding inside the insertion tip. If you wish to determine the magnitude of this force it can be done in the following manner.

Solder, braze, or weld a small solid wire (or rod) to the nose of the contact. The wire or rod shall be small enough that it clears the retaining springs or grommets of the connector. A hole must be provided through the closed side in terminal block type connectors so that the wire or rod can feed straight through with no obstructions. Insert the contact into place into a cavity which has no clip (retention spring), leaving the insertion tip (removed from the tool) in its inserted position in the connector. Anchor the connector so that it does not move. Attach a force gage (A) to the solid wire or rod protruding from the nose of the contact. Pull with force gage (B) on the insertion tip so as to remove it from the connector cavity. Gage A will show the portion of the force B which is transmitted to the wire and contact due to friction.

Pulling the insertion tip out of the connector by pulling on the wire of the contact is a situation which cannot occur in the use of the Positive Locking Contact Insertion Tool. If this were done it could be expected that the thin front end of the insertion tip would be collapsed and spread by the contact shoulder, adding a great deal of resistance to removing the insertion tip from the cavity.

We have checked out the two tools and found them to be in good working order. They are being returned to your attention today.

Very truly yours,

J. D. Anderson

J. D. Anderson
Engineering Manager
Installation Tool Products

cc: D. L. Pfendler, Bendix Corp.
H. Buttner
L. Tuck

Internal
Memorandum

Bendix Electrical Components Division

T73-35

Sidney, New York

Date January 26,1973 Letter No.

To Messrs. D. Pfendler, D. Gould (2), A. Surdovel

From Mr. Walter E. Denny

Subject Dielectric Retention Mechanism on a Dummy Size 16 Contact

---

Ref: CLT3287, ECL0540 Pg. 97, ECL0540A-109-112

Purpose

To evaluate a dielectric retention clip that is an integral part of the contact.

Samples Submitted

9 Pcs. L-27758-108/109 Contact Clip Assembly (P-360 Material)
1 Pc. L-27758-125/127 Test Fixture

Conclusions

1. The data obtained on the limited amount of sampling and with the special test fixture, instead of a connector, showed that the dielectric retention system on a contact under these circumstances has a good potential.

Detailed Report

The forces required to insert the special dielectric retention size 16 dummy contact system in the test fixture was measured by use of the Instron. The force was applied ata steady rate of approximately 1 lb. per second until the system was completely seated in the test fixture. The peak force of inserting this contact was the force recorded on ECL0540A-109. Initial maximum forces measured on the nine submitted contacts was 8 1/4 lbs.

The force required to remove this dielectric contact system from the special fixture was also measured. The force required to insert the removal tool and release the contact was also measured by the use of the Instron and again the peak force was recorded. Maximum initial release force was 7 3/4 lbs. (ECL0540A-109).

The force, after the release of the retention system, to push the contact out of the special fixture was also measured using the same measuring system. The maximum initial pushout force was 4 3/4 lbs. All of the initial forces measured seemed to be reasonable and fairly consistent. See included Data Sheet ECL0540A-109 for individual forces.

The nine submitted dielectric retention contacts were subjected to 10 cycles of maintenance aging. The contact system was inserted in the test fixture, contacts were released from the fixture with the removal tool and the contacts were then removed from the fixture. The peak forces required to insert, release and remove the contact were measured on each cycle to note if the forces tended to increase or decrease. In most cases the force tended to decrease. In some

Internal
Memorandum

Bendix Electrical Components Division
T73-35
Sidney, New York

Date January 26, 1973 Letter No.

To Messrs. D. Pfendler, D. Gould(2), A. Surdovel

From Mr. Walter E. Denny

Subject Page 2

cases the outer shoulder of the contact dielectric retention system tended to shear and in other cases the shoulder rolled up. In the shear case the forces were lower but in the cases of the rolling effect, the forces increased or remained fairly high. Maximum insertion force in the 10th cycle was 8 1/2 lbs. The maximum removal force was 4 lbs. and the maximum contact pushout force was 3 lbs. All forces were 1 lb. or greater and all retention systems worked throughout the cycling.

Four contacts with the dielectric retention mechanisms were inserted into the special fixture. A load was applied to the contact until the retention system failed. In all cases, the outside shoulder of the retention system failed in the test fixture but the retention system still retained the contact. The loads ranged from 53 to 81 lbs.

Four contacts were subjected to a 30 lb. load and the displacement was measured while under the full load conditions. Maximum displacement was .007".

Walter E. Denny

Walter E. Denny

ds

Attachments

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
Contact Insertion & Removal forces	1/3/73	173-35

TEST SPECIMEN (S): L-27758-108/109 Contact/clip Assembly

LT. 3287

TEMP. Room | R.H. Room | ECL/EPI 0540A-101

SPEC. | PARA.

TEST EQUIPMENT		CAL. DATE	DUE DATE
Instron	PG1050	8/25/72	2/25/73

SPEC. LIMITS

TEST CONDITIONS

Initial Forces

All Forces in lbs

Contact	Insertion force	Release force	Removal force
1	7 1/2 lbs	6 1/4 lbs	4 1/2 lbs
2	5 lbs	2 1/2 lbs	2 lbs
3	8 lbs	2 3/4 lbs	1 1/2 lbs
4	7 3/4 lbs	2 3/4 lbs	2 1/4 lbs
5	7 1/2 lbs	3 lbs	2 1/2 lbs
6	8 1/4 lbs	5 3/4 lbs	1 1/2 lbs
7	7 1/4 lbs	1 3/4 lbs	1 1/4 lbs
8	8	6	4 3/4
9	6 1/4	7 3/4	1 1/2

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: W. E. Denny

APPROVED BY: [illegible]

WITNESSED BY

72-354-2

1

TEST: Maintenance AGE (Contact Insertion force)	DATE OF TESTS: 1/3/73	TESTED BY: W.E. Denny	APPROVED BY: [illegible]	WITNESSED BY:	REPORT NUMBER: T73-35
TEST SPECIMEN(S): L-27758 - 108/109 Contact/clip assembly		SPECIFICATION: —	PARA.: —	LT. NO.: 3287	TEMP & R.H.: Room; ECL. 0540A-110; EPL.
TEST CONDITIONS: All forces in lbs	TEST EQUIPMENT: Instron PG 1050			CALIB. DATE: 8/25/72	DATE DUE: 2/25/73
SPEC. LIMITS: ———					

Contact	2nd Insertion	3rd Insertion	4th Insertion	5th Insertion	6th Insertion	7th Insertion	8th Insertion	9th Insertion	10th Insertion
1	10 lbs	7 lbs	3 3/4 lbs	4 1/2 lbs	5 1/2 lbs	5 1/2 lbs	6 1/2 lbs	6 lbs	2 3/4 lbs
2	6 3/4 lbs	6 lbs	5 1/4 lbs	6 3/4 lbs	7 lbs	6 1/2 lbs	4 3/4 lbs	4 1/4 lbs	3 lbs
3	6 1/2 lbs	5 1/2 lbs	3 lbs	4 1/4 lbs	2 3/4 lbs	4 3/4 lbs	4 lbs	2 3/4 lbs	2 1/2 lbs
4	6 3/4	5 1/4	6 3/4	6 3/4	6 1/2	5 1/2	3 3/4	3 3/4	3 3/4
5	4	4 1/4	5 1/2	4	8 1/2	6	7 1/2	7 1/4	4 3/4
6	~~8 1/4~~ 6	3 1/2	6	3 1/2	6	8 1/4	6	7 3/4	5 3/4
7	5	3 3/4	8	3 3/4	6	4	3 1/4	6 1/2	3 1/2
8	9 1/4	8 1/4	7	5	9 3/4	7 1/2	6 1/4	8 1/2	8 1/2
9	6 1/4	3 1/4	5 1/4	4 1/4	7	5 1/2	3 1/4	3	3

LABORATORY DATA SHEET

72-355-1

Bendix Electrical Components Division

Sidney, New York 13838

2

TEST: Maintenance Age (Contact Removal Force)	DATE OF TESTS: 1/3/73	TESTED BY: W.E. Denny	APPROVED BY: HCG	WITNESSED BY:	REPORT NUMBER: T 73-35
TEST SPECIMEN(S): L-2775E-108/109 Contact / clip assembly		SPECIFICATION: —	PARA.: —	LT. NO.: 3287	TEMP & R.H.: Room; ECL: 05401-111; EPL:
TEST CONDITIONS: All forces in lbs	TEST EQUIPMENT: Instron	PG 1050		CALIB. DATE: 8/25/72	DATE DUE: 2/25/73
SPEC. LIMITS:					

Contact	2nd Removal		3rd Removal		4th Removal		5th Removal		6th Removal		7th Removal		8th Removal		9th Removal		10th Removal	
	Tool Release	Contact Pushout	Tool Release	Contact Pushout	Tool Release	Contact Pushout	Tool Release	Contact Pushout	Tool Release	Contact Pushout	Tool Release	Contact Pushout	Tool Release	Contact Pushout	Tool Release	Contact Pushout	Tool Release	Contact Pushout
1	2 1/4	4	2 1/2	—	2 1/4	2 1/4	2 1/2	1 3/4	2	1 3/4	1 3/4	2	1 3/4	1 3/4	1 3/4	1 1/2	1 3/4	1 3/4
2	3	1 1/4	2 1/4	2	2 1/4	2 1/4	3 1/4	2	2	1 1/2	1 3/4	1 3/4	1 3/4	1 1/4	1 1/2	1 1/2	1 3/4	2
3	3	1 1/2	2	1	2	1 1/4	2 1/4	1	1 3/4	1	1 1/2	1 1/2	2 1/4	1 1/4	1 3/4	1	1 1/2	1
4	2	2	2 3/4	2	3	1 1/2	3	1 1/2	2 1/2	1 1/4	2	1 1/4	1 3/4	2	2	1 3/4	1 3/4	2 1/4
5	2 1/4	2 1/4	2 1/4	2 1/4	2 1/2	2 1/2	2	2 1/2	2	2 1/2	2 1/2	2	2	1 1/2	2	1 3/4	1 3/4	1 3/4
6	4	2	2 1/4	2 1/2	2	1 3/4	2	1 3/4	2 1/2	1 3/4	1 1/4	1 3/4	2 1/4	2	1 3/4	2	2	2
7	1 3/4	2	1 3/4	1 1/2	1 1/2	1 1/2	1 1/4	1 1/2	1 1/2	1 3/4	1 1/2	2	1 1/2	2	2	1 1/2	1 1/2	1 1/2
8	4	4 1/2	4 1/2	4	3 3/4	4 1/4	3	3 3/4	3 1/4	3 1/2	4 1/4	3 1/2	7	2 3/4	6	3	4	3
9	3 3/4	1 1/2	4 1/4	2	2 1/4	1 1/4	2	1 1/4	3 3/4	1 1/4	1 3/4	1 1/2	1 3/4	1 1/4	1 3/4	1 3/4	2 1/4	1 1/4

LABORATORY DATA SHEET

72-355-1

Bendix Electrical Components Division

Sidney, New York 13838

LABORATORY DATA SHEET

TEST	DATE OF TESTS	REPORT NUMBER
Contact Retention to destruction	1/15/73	T73-35

TEST SPECIMEN (S): L-27758-108/109 Contact clip
LT. 3287

TEMP.: | R.H.: | ECL EPL: 05401-112
SPEC.: | PARA.:

TEST EQUIPMENT		CAL DATE	DUE DATE
Lambia Power Supply	E-1484	1/1/73	6/22/73
Honeywell Recorder	F-1685	1/18/73	4/11/73
Strain Gauge	E-4011	Prior to use	

SPEC. LIMITS

TEST CONDITIONS

All Forces in Lbs

Contact	Load	Displacement
1	53 Lbs	.023"
2	59 lbs	.028"
5	81 lbs	7.050"
6	77 lbs	.035"

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: [signature]
APPROVED BY: [signature]
WITNESSED BY:

72-354-2

4

LABORATORY DATA SHEET

TEST: Contact Retention		DATE OF TESTS: 1/29/73	REPORT NUMBER: T73-25
TEST SPECIMEN (S): L-27758-108/109 Contact Clip		TEMP RM / R.H. RM	ECL C540A-113 EPL
	LT. 3287	SPEC.	PARA.

TEST EQUIPMENT		CAL. DATE	DUE DATE
Lambda Power Supply	F-1484	1/4/73	6/22/73
Honeywell Recorder	F-1685	1/11/73	4/11/73
Strain GAUGE	E-4011	Prior	to use

SPEC. LIMITS

TEST CONDITIONS

Contact	Load	displacement
4	30 lbs	.007 "
5	30 lbs	.0045 "
7	30 lbs	.007 "
9	30 lbs	.007 "

REF.

Bendix Electrical Components Division
Sidney, New York 13838

TESTED BY: M. E. [illegible]
APPROVED BY: ACS
WITNESSED BY

72-354-2

5

WARNING - This print is issued as advance technical information for development purposes only and it is not to be considered as an official document concerned in any way with any Government purchase which may be in progress. This print should not be used for the purpose of bidding or manufacture. For such purposes prints should be obtained from the Contracting Officer director through an intermediary prospective bidder or contractor.

Battelle
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201
Telephone (614) 299-3151
Telex 24-5454

March 17, 1972

Mr. A. J. Raffalovich
[illegible]
USAECOM
Fort Monmouth, New Jersey 07703

Dear Mr. Raffalovich:

The following comments are offered in response to the "Engineering Accomplishment Report" dated January 10, 1972, on Contract Number DAAB07-71-C-0090, which listed nine conclusions that show disadvantages of the lusterless, conductive coating developed on Contract DAAB07-69-C-0360. As we discussed over the phone, we have had no contact with Bendix personnel and assume their knowledge of the process came from one or more of the Technical Reports. Comments from Bendix are integrated with our response in the following list.

(1) "The plating is adaptable only to flat surfaces."

During the program, shaped parts, including cable connectors, were successfully plated. No problems associated with shape occurred during the program.

(2) "Barrel plating would not be possible."

Barrel plating was not investigated; therefore, it is not known if the process can be carried out by barrel plating. There is a reasonably good chance that a barrel-plating process could be devised. Based on our experience, both a lower current density and a higher pH might be needed for a barrel process.

(3) "In order to plate round parts, the parts would have to be continually rotated in the plating bath."

Round parts about 1/4 and 1-1/2 inches were plated uniformly without rotation.

(4) "The plating thickness used, 0.002 inch, is entirely too thick for connector applications. All threads would have to be heavily undercut."

The anodic pretreatment used to promote adhesion of nickel electroplates removed just enough metal so that threaded parts meshed after plating 0.002 inch of nickel. To provide good corrosion resistance and abrasion resistance, a substantial plate

thickness of about 0.002 inch is necessary. Good corrosion resistance was provided by the first 0.001 inch of plating, and good abrasion resistance was provided by the final 0.001 inch of the porous nickel.

(5) "It would be doubtful that good adhesion, especially after thermal shock, would be obtained without having a zincate treatment prior to plating."

Good adhesion was obtained which resisted separation when the basis metal was broken. Our experimental data show that the use of a zincate treatment sometimes gives good adhesion, but also promotes rapid lateral corrosion between the aluminum and the coating, leading to poor corrosion resistance.

(6) "Its good abrasion and corrosion resistance is probably due to its heavy thickness."

The thickness of the first layer of dense nickel, about 0.001 inch, is not considered "heavy" for providing good corrosion resistance. ASTM-B-456-71 lists a nickel thickness of 0.001 to 0.0016 inch for protecting steel with nickel-chromium coatings. Thinner coatings do not provide good corrosion durability in corrosive environments.

(7) "Its lubricity is probably a result of the inclusion of the carbon particles in the plating."

This conclusion may be valid. If so, the self-contained lubricant increases the resistance to abrasion of the lusterless, conductive coating.

(8) "Problems would be encountered in plating blind holes, whether threaded or not."

Plating in blind holes is a recurring problem for any plating process. The new process developed on Contract DAAB07-69-C-0360 is similar to all prior-art nickel plating processes in this respect.

(9) "In plating thickness common to connector parts (0.0002 inch), plated parts probably would not pass corrosion resistance tests."

This appears to be a valid statement. However, connectors plated with such a thin layer of nickel from any bath do not pass the combined requirements of low gloss, high conductivity, and good corrosion resistance. The new coating system was developed to meet all the requirements.

I hope these comments will supply you with the information you need. If not, please let us know and we will expand our discussion.

Sincerely,

Glenn R. Schaer

Glenn R. Schaer
Project Leader
Electrochemical Engineering
Technology Division

GRS:nkd

DISTRIBUTION LIST

Department of Defense

101 DEFENSE DOCUMENTATION CENTER
ATTN: DDC-TCA
CAMERON STATION (BLDG 5)
12 ALEXANDRIA, VIRGINIA 22314

102 DIR OF DEFENSE RESEARCH & ENGINEERING
ATTN: TECHNICAL LIBRARY
RM 3E-1039, THE PENTAGON
1 WASHINGTON, D. C. 20301

Department of the Navy

200 CHIEF OF NAVAL RESEARCH
ATTN: CODE 427
DEPARTMENT OF THE NAVY
1 WASHINGTON, D. C. 20325

201 NAVAL SHIPS SYSTEMS COMMAND
ATTN: CODE 20526 (TECHNICAL LIBRARY)
MAIN NAVY BLDG, RM 1528
1 WASHINGTON, D. C. 20325

203 NAVAL SHIPS SYSTEMS COMMAND
ATTN: CODE 6179B
DEPARTMENT OF THE NAVY
1 WASHINGTON, D. C. 20360

205 DIRECTOR
U. S. NAVAL RESEARCH LABORATORY
ATTN: CODE 2027
2 WASHINGTON, D. C. 20390

206 COMMANDING OFFICER AND DIRECTOR
U. S. NAVY ELECTRONICS LABORATORY
ATTN: LIBRARY
1 SAN DIEGO, CALIFORNIA 92152

207 COMMANDER
U. S. NAVAL ORDNANCE LABORATORY
ATTN: TECHNICAL LIBRARY
1 WHITE OAK, SILVER SPRING, MARYLAND 20910

209 AIR FORCE SYSTEMS COMMAND
STLO (SCTL-16)
NAVAL AIR DEVELOPMENT CENTER
1 JOHNSVILLE, WARMINSTER, PA. 18974

210 COMMANDANT, MARINE CORPS
HQ, U. S. MARINE CORPS
ATTN: CODE A04C
1 WASHINGTON, D. C. 20380

212 MARINE CORPS DEVELOPMENT & EDUC COMD
DEVELOPMENT CEN, ATTN: C-E DIV
1 QUANTICO, VIRGINIA 22134

215 NAVAL COMMUNICATIONS COMMAND
ATTN: COMNAVCUMM(N2)
5827 COLUMBIA PIKE
1 BAILEYS CROSSROADS, VIRGINIA 22041

Department of the Air Force

301 ROME AIR DEVELOPMENT CENTER (EMTLD)
ATTN: DOCUMENTS LIBRARY
1 GRIFFISS AFB, NEW YORK 13440

307 ELECTRONIC SYSTEMS DIVISION (ESTI)
L. G. HANSCOM FIELD
2 BEDFORD, MASSACHUSETTS 01730

310 RECON CENTRAL/AVRS
AF AVIONICS LABORATORY
1 WRIGHT-PATTERSON AFB, OHIO 45433

312 U. S. AIR FORCE SECURITY SERVICE
ATTN: TSG
1 SAN ANTONIO, TEXAS 78241

314 HQ, AIR FORCE SYSTEMS COMMAND
ATTN: SCTSE
1 ANDREWS AFB, MARYLAND 20331

315 AIR UNIVERSITY LIBRARY (3T)
1 MAXWELL AFB, ALABAMA 36112

319 AIR FORCE WEAPONS LABORATORY
ATTN: WLIL
1 KIRTLAND AFB, NEW MEXICO 87117

Department of the Army

405 OFC, ASST SEC OF THE ARMY (R&D)
ATTN: ASST FOR RESEARCH
ROOM 3-E-373, THE PENTAGON
1 WASHINGTON, D. C. 20310

406 CHIEF OF RESEARCH AND DEVELOPMENT
DEPARTMENT OF THE ARMY
2 WASHINGTON, D. C. 20315

409 COMMANDING GENERAL
U S ARMY MATERIEL COMMAND
ATTN: AMCMA-FE
1 WASHINGTON, D. C. 20315

415 COMMANDING GENERAL
U. S. ARMY MATERIEL COMMAND
ATTN: RSCH, DEV & ENGR DIR
1 WASHINGTON, D. C. 20315

421 CG, U. S. ARMY MISSILE COMMAND
REDSTONE SCIENTIFIC INFO CENTER
ATTN: CHIEF, DOCUMENT SECTION
3 REDSTONE ARSENAL, ALABAMA 35809

424 COMMANDING GENERAL
U. S. ARMY WEAPONS COMMAND
ATTN: AMSWE-RER-L
1 ROCK ISLAND, ILLINOIS 61201

433 HQ, US ARMY AVIATION SYSTEMS COMMAND
ATTN: AMSAV-C-AD
PO BOX 209
1 ST. LOUIS, MISSOURI 63166

442 COMMANDING OFFICER
HARRY DIAMOND LABORATORIES
ATTN: LIBRARY
1 WASHINGTON, D. C. 20438

449 COMMANDING OFFICER
PICATINNY ARSENAL
ATTN: SMUPA-VA6, BLDG 59
2 DOVER, N. J. 07801

462 COMMANDING OFFICER
U.S. ARMY MATERIALS AND MECH RSCH CEN
ATTN: AMXMR-ATL, TECH LIBRARY BRANCH
1 WATERTOWN, MASSACHUSETTS 02172

464 COMMANDING OFFICER
ABERDEEN PROVING GROUND
ATTN: TECHNICAL LIBRARY, BLDG 313
2 ABERDEEN PROVING GROUND, MARYLAND 21005

471 COMMANDING OFFICER
U. S. ARMY LIMITED WAR LABORATORY
1 ABERDEEN PROVING GROUND, MD. 21005

475 COMMANDING OFFICER
USA GARRISON
ATTN: TECHNICAL REFERENCE DIV
1 FORT HUACHUCA, ARIZONA 85613

476 COMMANDING OFFICER
U. S. ARMY ELECTRONIC PROVING GROUND
ATTN: STEEP-TA-E
2 FORT HUACHUCA, ARIZONA 85613

483 COMMANDER
U. S. ARMY RESEARCH OFFICE (DURHAM)
BOX CM-DUKE STATION
1 DURHAM, NORTH CAROLINA 27706

486 COMMANDING OFFICER
USA MOBILITY EQPT R&D CEN
ATTN: TECHNICAL DOCUMENT CEN, BLDG 315
2 FORT BELVOIR, VIRGINIA 22060

487 COMMANDING OFFICER
U. S. ARMY ENGINEER TOPOGRAPHIC LABS
ATTN: ETL-TE
1 FORT BELVOIR, VIRGINIA 22060

488 USA SECURITY AGCY COMBAT DEV ACTV
ATTN: IACDA-P(T) AND IACDA-P(L)
ARLINGTON HALL STATION, BLDG 420
2 ARLINGTON, VIRGINIA 22212

489 U. S. ARMY SECURITY AGCY PROCESSING CTR
ATTN: IAVAPC-R&D
VINT HILL FARMS STATION
1 WARRENTON, VIRGINIA 22186

492 COMMANDANT
U.S. ARMY AIR DEFENSE SCHOOL
ATTN: C&S DEPT, MSL SCI DIV
1 FORT BLISS, TEXAS 79916

503 DIRECTOR
U. S. ARMY ADVANCED MATL CONCEPTS AGCY
ATTN: AMXAM
1 WASHINGTON, D. C. 20315

595 COMMANDING OFFICER
U. S. ARMY COMBAT DEVELOPMENTS COMMAND
COMMUNICATIONS-ELECTRONICS AGENCY
1 FORT MONMOUTH, NEW JERSEY 07703

598 COMMANDING GENERAL
U. S. ARMY SATELLITE COMMUNICATIONS AGCY
ATTN: TECHNICAL DOCUMENTS CENTER
1 FORT MONMOUTH, NEW JERSEY 07703

U.S. Army Electronics Command

601 USAECOM LIAISON OFFICER
U. S. ARMY TANK-AUTOMOTIVE CENTER
WARREN, MICHIGAN 48090

* 604 U. S. ARMY LIAISON OFFICE
MIT, BLDG 26, RM 131
77 MASSACHUSETTS AVENUE
1 CAMBRIDGE, MASS. 02139

605 U. S. ARMY LIAISON OFFICE
MIT-LINCOLN LABORATORY, ROOM A-210
P. O. BOX 73
1 LEXINGTON, MASS. 02173

606 HEADQUARTERS
U.S. ARMY COMBAT DEVELOPMENTS COMMAND
ATTN: CDCLN-EL
1 FORT BELVOIR, VIRGINIA 22060

607 COMMANDING GENERAL
U. S. ARMY TANK-AUTOMOTIVE COMMAND
ATTN: AMSTA-Z, MR. R. MC GREGOR
1 WARREN, MICHIGAN 48090

608 USAECOM LIAISON OFC, STANFORD UNIV
SOLID STATE ELECTRONICS LAB
MCCULLOUGH BLDG
1 STANFORD, CALIFORNIA 94305

614 CHIEF
MISSILE ELECTRONIC WARFARE TECH AREA
EW LAB, USA ELECTRONICS COMMAND
1 WHITE SANDS MISSILE RANGE, N. M. 88002

* Increase to 50 copies if releasable to CFSTI. See para 6e(1) (b), ECOMR 70-31, for types of reports not to be sent to DDC.

* **Unclassified, unlimited reports only.**

(CONTD)

680 COMMANDING GENERAL
U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH, N. J. 07703

1 AMSEL-[redacted] 5/-CM
1 AMSEL-ME-NMP-PS
2 AMSEL-T[redacted] MS-TI
1 AMSEL-RD-MT

1 AMSEL-RD-LNS
1 AMSEL-XL-D
1 AMSEL-NL-D
1 AMSEL-WL-D
1 AMSEL-VL-D
3 AMSEL-HL-CT-D
1 AMSEL-BL-D
1 AMSEL-[redacted] TL-DT
* 3 AMSEL-[redacted] TL-D
1 AMSEL-[redacted]-TL-ME (Ofc of Record)

~~1 AMSEL-SC~~
~~1 AMSEL-RD-D~~
~~1 AMSEL-RD-LNF~~
~~1 AMSEL-KL-D~~
~~25 Originating Office~~
~~ECOM In-house reports only~~

* Or number specified in contract. Add COTR's mail symbol.

Other Recipients

701 DIRECTOR, ELECTRONIC DEFENSE LABS
SYLVANIA ELECTRIC PRODUCTS, INC.
ATTN: DOC ACQ LIBRARY, P.O. BOX 205
1 MOUNTAIN VIEW, CALIFORNIA 94040

703 NASA SCIENTIFIC & TECH INFO FACILITY
ATTN: ACQUISITIONS BRANCH (S-AK/DL)
P. O. BOX 33
2 COLLEGE PARK, MARYLAND 20740

704 PROJECT SETE
NYU COLLEGE OF ENGINEERING & SCIENCE
401 W. 205TH ST (RSCH BLDG 2)
1 NEW YORK, N. Y. 10034

705 ADVISORY GROUP ON ELECTRON DEVICES
201 VARICK ST, 9TH FLOOR
2 NEW YORK, NEW YORK 10014

709 BATTELLE-DEFENDER INFO CENTER
BATTELLE MEMORIAL INSTITUTE
505 KING AVENUE
1 COLUMBUS, OHIO 43201

710 DEFENSE CERAMIC INFORMATION CENTER
BATTELLE MEMORIAL INSTITUTE
505 KING AVENUE
1 COLUMBUS, OHIO 43201

711 DEFENSE METALS INFORMATION CENTER
BATTELLE MEMORIAL INSTITUTE
505 KING AVENUE
1 COLUMBUS, OHIO 43201

715 PLASTICS TECH EVAL CENTER
PICATINNY ARSENAL, BLDG 3401
1 DOVER, NEW JERSEY 07801

716 RADIATION EFFECTS INFORMATION CENTER
BATTELLE MEMORIAL INSTITUTE
505 KING AVENUE
1 COLUMBUS, OHIO 43201

717 RELIABILITY ANALYSIS CENTER
ROME AIR DEVELOPMENT CENTER
ATTN: EMERR
1 GRIFFISS AFB, NEW YORK 13440

719 SHOCK AND VIBRATION INFO CENTER
NAVAL RESEARCH LABORATORY (CODE 6020)
1 WASHINGTON, D. C. 20390

720 THERMOPHYSICAL PROPERTIES RES CENTER
PURDUE UNIVERSITY, RESEARCH PARK
2595 YEAGER ROAD
1 LAFAYETTE, INDIANA 47906

721 VELA SEISMIC INFO CENTER
UNIVERSITY OF MICHIGAN
BOX 618
1 ANN ARBOR, MICHIGAN 48107

504 COMMANDING GENERAL
U. S. ARMY MATERIEL COMMAND
ATTN: AMCRD-R (H. COHEN)
1 WASHINGTON, D. C. 20315

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) The Bendix Corporation Electrical Components Division Sidney, New York 13838	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

Reliable Integrated Wire Termination Devices

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Technical Report - Final

5. AUTHOR(S) (First name, middle initial, last name)

Donald L. Pfendler
Donald H. Gould

6. REPORT DATE July 1973	7a. TOTAL NO. OF PAGES 202	7b. NO. OF REFS None
8a. CONTRACT OR GRANT NO. DAAB07-71-C-0090 b. PROJECT NO. IF162203A119 c. Task 35 d. Sub-Task 01	9a. ORIGINATOR'S REPORT NUMBER(S) 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) ECOM-0090-F	

10. DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY U.S. Army Electronics Commd. AMSEL-TL-ME Fort Monmouth, New Jersey

13. ABSTRACT

This final report covers an investigation into the design and evaluation of a single wire termination system capable of interconnection to various existing designs of multi-contact connectors. The devices utilizing this termination system were to be capable of assembly and maintenance with a common tool. In addition, the devices were to reliably withstand the environmental conditions encountered by ground and airborne Army equipment with emphasis on improvement for Army aircraft. The concept designed and evaluated makes waterproof connectors having crimp removable MS27491 series contacts practical to produce. However, to obtain sound insert moldings, minimum spacing between contact centerlines had to be established as follows:

Terminal Size	22D	20	16	12
Minimum Space	.090 in. (tentative)	.130 in.	.190 in.	.238 in.

It was found that the contact spacing of MIL-C-81511 connectors is inadequate for use with MS27491-22D contacts. Terminal insertion and removal tools were obtained, evaluated, and found useful. Terminal insertion and removal tips used for 22D contacts were mechanically weak. If the tip wall section must be increased, which is still to be determined, or if the dielectric wall thickness between contact cavities is inadequate for a reliable design, then the .090 in. spacing for this contact size may have to be increased.

Unclassified
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Connectors						
Contacts						
Terminations						
Retentions						

Unclassified
Security Classification